TWENTIETH
ANNUAL REPORT.

To his Excellency, the Governor, Chairman of the Board of Agriculture and to the Honorable the General Assembly of the State of Vermont.

In compliance with Section 247 Chapter 21 of the General Laws of Vermont, I have the honor to submit herewith the Annual Report of the Board of Agriculture for the year ending June 30th, 1900.

C. J. BELL, Secretary.

BRADFORD:
Press of the Opinion Publishing Company.
900.

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MEMBERS

OF THE

STATE BOARD OF AGRICULTURE.

1900.

His Excellency, EDWARD C. SMITH, St. Albans, *Chairman.*

MATTHEW H. BUCKHAM, President University of Vermont and State Agricultural College, Burlington.

C. J. BELL, Walden, P. O., East Hardwick, *Secretary.*

Prof. J. L. HILLS, Burlington.

JAMES K. CURTIS, Georgia, P. O., St. Albans.

FORMER MEMBERS

OF THE

STATE BOARD OF AGRICULTURE,

1871-72.

His Excellency, JOHN W. STEWART.
James B. Angell, President State Agricultural College.
*Peter Collier, Secretary of the Board.

A. B. Halbert, Essex,
*Charles H. Heath, Plainfield.
Frederick Holbrook, Brattleboro.
*Pitt W. Hyde. Castleton.
*Z. E. Jameson, Irasburgh.
*Noah B. Safford, White River Junction.

1873-74.

*His Excellency, JULIUS CONVERSE.
Matthew H. Buckham, President State Agricultural College.
*Peter Collier, Secretary of the Board.

A. B. Halbert, Essex.
*Charles H. Heath, Montpelier.
*Francis D. Douglas, Whiting.
*Pitt W. Hyde, Castleton.
*Z. E. Jameson, Irasburgh.
Thomas H. Hoskins, Newport.

1875-77.

*His Excellency, ASAHEL PECK.
Matthew H. Buckham, President State Agricultural College.
*Peter Collier, Secretary of the Board.

Thomas L. Sheldon, Rupert.
Alexis T. Smith, New Haven.
*John B. Mead, Randolph.
*C. Horace Hubbard, Springfield.
Gardner S. Fassett, Enosburgh.
Cyrus D. Prindle, Charlotte.
John H. Mead, West Rutland.

1877-78.

*His Excellency, HORACE FAIRBANKS.
Matthew H. Buckham, President State Agricultural College.
Henry M. Seeley, Secretary of the Board.

Gardner S. Fassett, Enosburgh.
*Peter Collier, Burlington.
*Albert Chapman, Middlebury.
*John H. Mead, West Rutland,
*Ora Paul, Pomfret.
Henry Chase, Lyndon.

1879-80.

Under change of law, John B. Mead, of Randolph, was "Superintendent of Agricultural affairs."

1881-82.

His Excellency, ROSWELL FARNHAM.
Matthew H. Buckham, President State Agricultural College.
*Hiram A. Cutting, Secretary of the Board.

*Henry Lane, Cornwall.
*E. M. Goodwin, Hartland.
*M. W. Davis, Westminster.
*H. F. Lothrop, Pittsford.
Gardner S. Fassett, Enosburgh.
E. R. Towle, Franklin,
E. R. Pember, Wells.

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*Dead,

1883-84.

His Excellency, JOHN L. BARSTOW.
Matthew H. Buckham, President State Agricultural College.
*Hiram A. Cutting, Secretary of the Board.

*Henry Lane, Cornwall.
*E. M. Goodwin, Hartland.
E. R. Pember, Wells.
E. R. Towle, Franklin.
*W. M. Davis, Westminster.

1885-1886.

His Excellency, SAMUEL E. PINGREE.
Matthew H. Buckham, President State Agricultural College.
*Hiram A. Cutting. Secretary of the Board.

*Henry Lane, Cornwall.
*M. W. Davis, Westminster.
E. R. Towle, Franklin.
*F. D. Douglas, Whiting.
A. E. Perkins, Pomfret.

1887-1888.

His Excellency, EBENEZER J. ORMSBEE.
Matthew H. Buckham, President State Agricultural College.
W. W. Cook, Secretary of the Board.

*Henry Lane, Cornwall.
*M. W. Davis, Westminster.
*D. L. Cushing, Quechee.
H. H. Hill, Isle LaMotte.
R. C. Smith. Pittsford.
H. W. Vail, Pomfret.
William Chapin, Middlesex.

1889-1890.

His Excellency, WILLIAM P. DILLINGHAM.
Matthew H. Buckham, President State Agricultural College.
W. W. Cooke, Secretary of the Board.

*M. W. Davis, Westminster.
R. C. Smith, Pittsford.
H. W. Vail, Pomfret.
William Chapin, Middlesex.
C. M. Winslow. Brandon.

1891-1892.

His Excellency, CARROLL S. PAGE.
Matthew H. Buckham, President State Agricultural College.
W. W. Cooke, Secretary of the Board.

R. C. Smith, Pittsford.
William Chapin, Middlesex.
H. W. Vail, Pomfret.
J. O. Sanford. Stamford.
Victor I. Spear, Braintree.

1893-1894.

*His Excellency, LEVI K. FULLER.
Matthew H. Buckham President State Agricultural College.
C. M. Winslow, Brandon, Secretary of the Board.
Victor I. Spear, Braintree, Statistical Secretary.

H. W. Vail, Pomfret.
J. O. Sanford, Stamford.
Prof. J. L, Hills, Burlington.
*H. M. Arms, Springfield.

1895-1896.

His Excellency, URBAN A. WOODBURY.
Matthew H. Buckham, President State Agricultural College.
C. M. Winslow, Brandon, Secretary of the Board.
Victor I. Spear, Braintree, Statistical Secretary.

H. W. Vail, Pomfret.
J. O. Sanford, Stamford.
Prof. J. L. Hills, Burlington.
*H. M. Arms, Springfield.
F. C. Williams, Coventry.

1897-1898.

His Excellency, JOSIAH GROUT.
Matthew H. Buckham, President State Agricultural College.
Victor I. Spear, Randolph, Secretary of the Board.
F. C. Williams, Coventry, Assistant Secretary of the Board.

J. O. Sanford, Stamford.
Prof. J. L, Hills, Burlington.
Alpha Messer, Rochester.
C. J. Bell, Walden.
J. K. Curtis, Georgia.
J. H. Ware, Townshend.

*Dead.

AN ACT TO PROVIDE FOR THE PRINTING OF THE REPORT OF THE VERMONT DAIRYMEN'S ASSOCIATION.

It is hereby enacted by the General Assembly of the State of Vermont:

Section 1. Section two hundred and forty-seven of the Vermont Statutes shall be amended so as to read as follows:

The Secretary shall prepare on or before the 30th day of June annually, a detailed report of the proceedings of the Board with such suggestions in regard to its duties and the advancement of the interests herein specified as may seem pertinent, and he may append thereto such abstracts of the proceedings of the several agricultural societies, and farmers' clubs in the State as may be advisable, and the report of the Vermont Dairymen's Association. The report shall show under separate heads the work of the Board relating to the different subjects herein mentioned.

Sec. 2. The provisions of section two hundred and fifty-one of Vermont Statutes requiring the printing of a report by the Vermont Dairymen's Association is hereby repealed.

Approved November 24, 1896.

CHAPTER 203.

PRESERVATION OF CATTLE AND SHEEP.

Section 4802. If sheep are affected with "hoof ail" or "foot rot" or with the "scab," the owner or keeper thereof shall restrain them from running at large in the public highways or commons, and keep them in an enclosure; and if he, knowing them to be diseased, knowingly permits them to go

at large upon a common or public highway, or if such sheep, while so diseased are found in an enclosure other than that of such owner or keeper, he shall be fined ten dollars, to the use of the town where such offense is committed, and shall also be liable to the party injured for the damage sustained, in an action upon this statute,.

Sec. 4803. If sheep, infected with the "hoof ail" or "foot rot," are found at large upon common, public highway, or lane, on lands not owned or occupied by their owner or keeper, through the neglect of such owner or keeper, said sheep shall become forfeit to any person who takes them up, and the owner of such sheep shall not have an action at law or equity for their recovery.

PLEURO-PNEUMONIA AND OTHER INFECTIONS DISEASES.

Sec. 4804. If a person drives or brings domestic animals into this State, or is accessory thereto, knowing that any of them have the disease, or have been exposed to the disease, known as pleuro-pneumonia, he shall be fined not more than five hundred dollars, or be imprisoned not more than twelve months and not less than one month, in the discretion of the court.

Sec. 4805. A town, at a meeting held for that purpose, may establish regulations, appoint officers, or agents, and raise and appropriate money to arrest and prevent the spread of the cattle disease known as pleuro-pneumonia.

Sec. 4806. The selectmen may perform all acts and make all rules and regulations for and in behalf of the town, necessary to carry into effect the powers conferred on the town by this chapter, until the town otherwise orders at a meeting holden for that purpose.

Sec. 4807. If a person brings in to this State any domestic animal which he knows to be infected with an infectious or contagious disease, or exposes such cattle or other animals known to him to be so infected, to other cattle and animals not infected with such disease, he shall be fined not more than five hundred dollars, and not less than one hundred dollars.

Sec. 4808. The selectmen of the towns and the board of aldermen of the cities of this State, may make and enforce such regulations as they deem proper, to prevent the spread of infectious or contagious diseases among domestic animals, within their respective towns and cities, and shall inquire into all such cases coming to their knowledge, and shall immediately report the same to the governor. A person who knowingly violates or refuses to obey such regulations made by such town or city authorities shall be fined one hundred dollars.

BOARD OF AGRICULTURE.

Sec. 4809. The Board of Agriculture may prohibit the introduction of horses or other domestic animals, believed to be infected with or exposed to any contagious disease, into this State, or may quarantine all such animals for such time as the public good requires; but shall not prohibit the transportation of the same in cars through this State.

Sec. 4810. If a person violates such order, after the same has been published three successive days in such newspapers published in this State as the Board directs, he shall be fined not more than three hundred dollars for each offense, and every officer or agent of any company or other person who violates such order, shall be fined as aforesaid. The introduction into this State at the same time of a number of horses, cattle, or other domestic animals, contrary to the orders of such Board, shall be deemed a separate and distinct offenes for each animal.

Sec. 4811. The Board shall endeavor to obtain full information in relation to any contagious disease which may prevail among domestic animals near the borders of the State, and publish and circulate such information at their discretion; and should any such disease break out, or should there be reasonable suspicion of its existence among cattle or other domestic animals in any town in this State, they shall examine the cases and publish the results of their examination for the benefit of the public. The board is also authorized to examine under oath in the several towns and cities in this State, all persons possessing or believed to possess knowledge of any material facts concerning the existence or dissemination of diseases among domestic animals, and for this purpose shall have all the power now conferred upon justices of the peace to compel witnesses to attend and testify.

Sec. 4812. All costs and expenses incurred in procuring the attendance of such witnesses shall be allowed by the State auditor, upon the approval of the Governor, and be paid by the State.

Sec. 4813. When bovine tuberculosis or any contagious disease exists in the State among cattle or other domestic animals, the Board of Agriculture may quarantine all infected animals or such as they suppose have been exposed to the contagion, may prohibit any animal from passing on or over any of the highways near the place of quarantine, may enter upon any premises where there are animals suspected to have bovine tuberculosis or any contagious disease, may employ such expert help and means as they deem necessary to a thorough invetigation of such diseases, may make all investigations and

regulations they deem necessary for the detection, prevention, treatment, cure and extirpation of such disease, but shall not apply the tuberculin test without the consent of the owner of the cattle, but in quarantine regulations against cattle imported from without the State the tuberculin test may be applied, and they may condemn and order killed any cattle or other domestic animals believed by said Board to be infected with bovine tuberculosis or any contagious disease, and may order the bodies of the same buried or burned, as in their judgment the case may require; may forbid the sale or removal from the premises of any dairy product from cows that are believed to have bovine tuberculosis. Any person who shall knowingly violate or refuse to comply with any order or regulation of such Board, made under the authority of this section, shall be fined not more than two hundred dollars, or be imprisoned not more then two years or both.

Sec. 4814. If any person shall sell or offer to sell any cattle or other domestic animals known to him to be infected with bovine tuberculosis or any contagious disease, or any disease dangerous to the public health, or shall sell or offer to sell any part or parts of such cattle or other domestic animals, he shall be fined not more than two hundred dollars or be imprisoned not more than two years, or both.

Sec. 4815. The value of cattle or other domestic animals killed by the written order of the Board of Agriculture shall be appraised by one of said Board and a disinterested person selected by the owner of the condemned animals, if these two cannot agree upon the amount of the appraised value of the animals, they shall select a third disinterested person, who together with them shall appraise the animals, such appraisal to be made just before killing, and on a basis of health. The limit of the appraisal of cattle shall be forty dollars. A *post mortem* examination shall be made, and if the animal be found affected with bovine tuberculosis, or any disease dangerous to the public health, the owner of the animal shall receive one-half the appraised value; but if no bovine tuberculosis or disease dangerous to the public health be found, the owner of the animal shall receive the full amount of the appraisal, and in addition shall receive the slaughtered animal. The amount which the owner is entitled to receive shall be paid by the State to the owner of such animal or animals upon a written order, signed by the member of the Board in charge, and countersigned by the secretary of said Board. No indemnity shall be paid to the owner of condemned cattle or other domestic animals that have not been owned or kept in the State for at least six months previous to the discovery of the disease. Any person who shall knowingly

violate, or refuse to comply with any regulations made by such Board of Agriculture, under the authority and provisions of this section, shall be fined not more than two hundred dollars, or imprisoned not more than two years., or both.

Sec. 4816. All expenses incurred by the Board under the provisions of this act shall be allowed by the State auditor, upon the approval of the Governor, and be paid by the State.

Sec. 4817. Whenever the Board shall make and publish regulations concerning the extirpation, cure or treatment of domestic animals infected with, or which have been exposed to, any contagious disease, such regulations shall supersede the regulations made by the slectmen of the several towns, or the board of aldermen of the several cities, upon the same subject; and the operation of such regulations made by said authorities, shall be suspended during the time those made by the Board aforesaid are in force.

Sec. 4818. The Board shall keep a record of its doings and report the same to the Governor, prior to the fifteenth day of September, annually, unless sooner required.

Sec. 4819. All orders, appointments and notices from the Board shall be signed by a majority of the same.

Sec. 4820. Every prosecution for a violation of any of the provisions of this chapter, shall be commenced within sixty days from the commission thereof.

AN ACT TO AMEND SECTION 4820 OF CHAPTER 203 OF THE VERMONT STATUTES, RELATING TO PRESERVATION OF CATTLE AND SHEEP.

It is hereby enacted by the General Assembly of the State of Vermont:

Section 1. Section four thousand eight hundred and twenty of the Vermont statutes is hereby amended so as to read as follows:

Every prosecution for a violation of any of the provisions of this chapter, shall be commenced within six months from the commission thereof.

Sec. 2. This act shall take effect from its passage.
Approved November 7, 1896.

CHAPTER 183.

REGULATING MAUFACTURE AND SALE OF PROVISIONS.

MILK AND CHEESE.

Section 4327. A person who sells or furnishes, or has in his possession with intent to sell or furnish milk diluted with water, adulterated, or not of good standard quality; or from which the cream or any part has been taken, or keeps back part of the milk known as "strippings" shall, for each offense, be fined not more than three hundred dollars and not less than fifty dollars.

Sec. 4328. In all creameries and cheese factories in this state milk containing four per cent. of butter fat shall be the standard used as a paying basis.

Sec. 4329. Where, in prosecutions under the preceding section the ordinary means of proof are not available or sufficient, sealed samples of the milk sold or furnished, or kept with intent to be sold or furnished, taken from such milk in the presence of at least one disinterested witness and with the knowledge and in the presence of the person or his agent or servant so selling or furnishing, or having in his possession with intent to sell or furnish said milk, may be sent to the state agricultural experiment station to be tested; the result of such test shall be deemed competent evidence in such prosecutions but shall not exclude other evidence.

Sec. 4330. Said samples shall be placed in tin or glass vessels securely sealed with a label thereon stating the time when, place where, the sample was drawn, from whose milk taken and signed by the person taking the same and by one or more disinterested witnesses. Upon request a like sample shall be given to such person, his agent or servant, for which a receipt shall be given to the person taking or drawing the same.

Sec. 4331. Standard milk shall contain not less than twelve and one-half per cent. of solids, or not less than nine and one-fourth of total solids exclusive of fat, except in the months of May and June, when it shall contain not less than twelve per cent. of total solids. This rule shall govern tests made at the experiment station, and an officer or employee thereof found guilty of fraud in making tests shall be fined one thousand dollars.

Sec. 4332. A person who marks or otherwise designates or causes to be marked or otherwise designated as "creamery" butter or cheese, or the package in which it is contained, when such butter or cheese is not manufactured at a creamery, or sells or offers to sell any such butter or cheese so marked, shall be fined not more than three hundred dollars and not less than fifty dollars.

Sec. 4333. Justices shall have concurrent jurisdiction with the county court in persecutions under the four preceding sections.

IMITATIONS OF BUTTER AND CHEESE.

Sec. 4334. No person by himself, his agent, or servant, shall manufacture out of animal fat, or animal or vegetable oils not produced from unadulterated milk or cream, any article in imitation of butter or cheese, or mix with or add to milk, cream or butter any acids or other deleterious substances, animal fats, or animal or vegetable oils so as to produce an article in imitation of butter or cheese.

Sec. 4335. If a person violates the provisions of the preceding section he shall be fined not more than three hundred dollars, and not less than one hundred dollars, or be imprisoned for not more than one year and not less than six months for the first offense; and for each subsequent offense shall be fined not more than one thousand dollars and not less than three hundred dollars or imprisoned for one year. One-half of the fine shall go to the complainant.

Sec, 4336. If a person by himself, his agent, or servant, sells, exposes for sale, or has in his possession with intent to sell, any article made in imitation of butter, that is of any other color than pink, shall, for every package sold or exposed for sale, be fined fifty dollars, and for each subsequent offense one hundred dollars. One-half of the fine shall go to the complainant.

Sec. 4337. If a proprietor or keeper of a hotel, restaurant, boarding house, eating saloon or other place where food is furnished to persons paying for the same, places upon the table or has in his possession with intent to use, any article made in imitation of butter, that is of any other color than

pink, he shall be fined fifty dollars for the first offense, and for each subsequent offense one hundred dollars. One-half of the fine shall go to the complainant.

Sec. 4338. The complainant may cause specimens of suspected butter or cheese to be analyzed or otherwise tested as to color and compounds; the expense of such analysis or test not exceeding twenty dollars, in any case, may be included in the cost of prosecution.

Sec. 4339. A justice of the peace may issue a warrant for searching, in the day-time, any store, hotel, boarding house, or other place where oleomargarine butterine, or other substance imitating butter or cheese is suspected to be kept or concealed, when the discovery of such article may tend to convict a person of any offense under the five preceding sections. No warrant shall be issued except upon the oath of some person that he has reason to suspect and does suspect that such article or articles are kept or concealed in the place to be searched.

Sec. 4340. The term "butter" shall mean the product usually known by that name, manufactured exclusively from milk or cream or both, with or without salt or coloring matter.

LARD.

Sec. 4341. No person by himself, his agent or servant, shall prepare, sell or expose for sale lard or any substance intended for use as lard, which contains any ingredients but the pure fat of swine, in any tierce, bucket, pail or other package under a label bearing the words "pure," "refined," or "family," alone or in combination with other words, unless the package containing the same bears upon the outside thereof, in letters not less than one-fourth of an inch long, the words, "Compound Lard."

Sec. 4342. A person violating the provisions of the preceding section shall be fined not more than fifty dollars for each offense.

MAPLE SUGAR AND HONEY.

Sec. 4343. A person who adulterates maple sugar, maple syrup, or bees' honey with cane sugar, glucose, or any subs stance whatever for the purpose of sale or knowingly sell maple sugar, maple syrup or bees' honey that has been adulterated, shall be punished by a fine of not more than two hundred dollars and not less than fifty dollars for each offense; one-half of such fine shall go to the complainant.

CHAPTER 222.

OFFENSES AGAINST PUBLIC HEALTH.

Section 5073. A person who knowingly sells diseased, corrupted or unwholesome provisions. for food or drink, shall be imprisoned not more than six months, or fined not more than three hundred dollars.

Sec. 5074. A person who kills or causes to be killed, with intent to sell the meat thereof for family use, a calf less than four weeks old, or knowingly sells or has in his possession such meat with intent to sell the same in the state or to send the same for such use to any foreign market shall be punished as provided in the preceding section.

CHAPTER 21.

BOARD OF AGRICULTURE.

Section 245. The Governor. the President of the University of Vermont and State Agricultural College, and three other persons appointed by the Governor. and confirmed by the senate during each biennial session of the General Assembly and who shall hold their office for the term of two years from and after the first day of December in the year in which the appointment is made, shall constitute the Board of Agriculture for the improvement of the general interests of husbandry, the promotion of agricultural education throughout the State, and for the discharge of such other duties as are hereinafter set forth; vacancies in the Board shall be filled by the Governor. Said Board shall appoint from its number a Secretary.

Sec. 246. The Board shall hold one meeting in each county annually, and others if deemed expedient, and may employ lecturers, essayists or other aid in conducting said meetings, managing its affairs generally and discharging its duties. At such meetings it shall present subjects for discussion, and among other topics forestry and tree planting, roads and road making.

Sec. 247. The Secretary shall prepare on or before the thirtieth day of June, annually, a detailed report of the proceedings of the Board, with such suggestions in regard to its duties, and the adancement of the interests herein specified as may seem pertinent; and he may append thereto such ab-

stracts of the proceedings of the several agricultural societies and farmers' clubs in the State as may be advisable. The report shall show under separate heads the work of the Board relating to the different subjects herein mentioned.

Sec. 248. The Board shall collect authentic statistical information, as full as possible, relating to agriculture and agricultural products, farms and farm property, the manufacturing and mining industries of the State, which under a separate head, shall form a part of its annual report; and such information shall be complete as to unoccupied farms. The Board shall also publish such information in separate form showing by description and illustrations, the resources and attractions of Vermont; also the advantages the State offers and invitations it extends to capitalists, tourists, and farmers; and shall distribute the same in such manner as, in its judgment, will be most effective in developing the resources and advertising the advantages of the State.

CHAPTER 184.

COMMERCIAL FERTILIZERS.

Section 4346. The term "commercial fertilizer" as used in this chapter shall mean compounds and manufactured substances containing or represented as containing, two or more of the following ingredients, namely: nitrogen, ammonia, potash and phosphoric acid, but shall not apply to the separate ingredients used to manufacture the same, or to bone meal land plaster, lime, or any substance the product of nature, which has not been compounded.

Sec. 4347. The term "importer" as used in this chapter shall mean a person who procures or sells fertilizers made in other states.

Sec. 4348. Every lot or parcel of commercial fertilizer, or material used for manurial purposes, sold or exposed for sale, the retail price of which is ten dollars or more per ton, shall be accompanied by a plainly printed statement, clearly and truly certifying the number of net pounds of fertilizer in a package, the name, brand or trade-mark under which the

fertilizer is sold, the name and address of the manufacturer or importer, the place of manufacture, and a chemical analyses stating the percentage of nitrogen or its equivalent in ammonia, of potash soluble in distilled water and of phosphoric acid soluble in distilled water and reverted, as well as the total phosphoric acid. Fertilizers composed of other and cheaper materials, shall bear labels giving a correct general statement of the composition and ingredients thereof.

Sec. 4349. Before any commercial fertilizer, the retail price of which is ten dollars or more per ton, is sold, or exposed for sale, the importer, manufacturer or party who causes it to be sold or offers it for sale, shall file with the director of the agricultural experiment station a certified copy of the statement required by the preceding section, and shall also deposit with said director, at his request, a sealed jar, glass or bottle containing not less than one pound of the fertilizer, accompanied by an affidavit that it is a fair average sample thereof.

Sec. 4350. The manufacturer, importer or agent of a commercial fertilizer or material used for manurial purposes, the retail price of which is ten dollars or more per ton, shall, before the fertilizer is offered for sale, obtain a license from the state treasurer countersigned by the director of the agricultural experiment station, authorizing the sale of the same in the state and shall securely affix to each barrel, bag or other package of fertilizer the word "Licensed," with the date of the license. The manufacturer, importer or agent obtaining such license shall pay to the state one hundred dollars for the same and the license shall expire on the thirty-first day of December of the year for which it is issued. One license shall cover all brands manufactured by one party.

Sec. 4351. Manufacturers and importers of a commercial fertilizer sold or offered for sale, the retail price of which is ten dollars or more per ton, shall, before such fertilizer is sold, or exposed for sale, file with the state treasurer, a bond, with sureties residing within the state satisfactory to said treasurer, in the sum of one thousand dollars payable to the state and conditioned for the payment of fine and costs imposed on such maufacturers and importers for violating the provisions of this chapter, and such bond shall be renewed from time to time, as the state treasurer requires.

Sec. 4352. No person shall sell or expose for sale, any pulverized leather in any form, as a fertilizer, or as an ingredient thereof, without an explicit printed certificate of the fact conspicuously affixed to each package.

Sec. 4353. A person selling or exposing for sale a commercial fertilizer without the statement required by this chap-

ter, or containing a smaller percentage of any one or more of the ingredients named than is specified on the label, or who fails to comply with any of the preceding sections of this hcapter, shall be fined fifty dollar for the first offense and one hundred dollars for each subsequent offense. This section shall not affect parties manufacturing, importing or purchasing fertilizers for their own use.

Sec. 4354. Manufacturers and importers of commercial fertilizers or wholesale dealers in the same shall, not later than the first day of February, annually, furnish the director of the agricultural experiment station with the names of the brands offered for sale and their agents in this state, and on the first of each succeeding month until May, such additional agents as in the meantime have been appointed.

Sec. 4355. Said director shall cause one analysis or more of each fertilizer or material used for manurial purposes, to be made annually and the result published monthly. He may, in person or by deputy, take a sample not exceeding two pounds in weight for analysis from any lot or package of fertilizer, or any material used for manurial purposes, which is in the possession of any manufacturer, importer, agent or dealer; but said sample shall be drawn in the presence of the party in interest, or his representative, and shall be taken from a parcel or number of packages which shall not be less than five of the whole lot inspected, and shall be thoroughly mixed and then divided into two equal samples and placed in glass vessels, carefully sealed, and a label placed on each stating the name of the brand of the fertilizer or material sampled, the name of the party from whose stock the sample was drawn, and the time and place of drawing. Said label shall be signed by the director or his deputy and by the party in interest, or his representative present at the drawing and sealing of said samples; one of said duplicate samples shall be retained by the director and the other by the party whose stock was sampled.

Sec. 4356. The director of the agricultural experiment station shall notify the state treasurer of all violations of this chapter and the state treasurer shall commence a suit, in the name of the state on the bond required to be filed by such manufacturer or importer and prosecute the same to the final judgment.

Sec. 4357. Whenever any violations of this chapter are brought to the attention of the state treasurer, he shall give written notice thereof to the manufacturers and importers, and they shall have not less than thirty days thereafter to comply with the requirements of the law.

Sec. 4358. If the fertilizer or fertilizing material is sub-

stantially equivalent to the statement of analysis made by the manufacturers or importers, no prosecution shall be had under this chapter. All analyses of fertilizers provided for by this act, including the collection of samples for such analyses, shall be made by the director of the Vermont Agricultural Experiment Station at the expense of said station, and so much of the license fees collected under this act shall be paid by the state treasurer to the treasurer of said station as the director of said experiment station may show by his bills he has expended in performing the duties required by this chapter, but in no case to exceed the amount of the license fees received by the treasurer under this chapter, such payment to be made annnually on or before the first day of September, upon the order of the state auditor, who is hereby directed to draw his order for such purpose.

No. 81.—AN ACT FOR THE PROTECTION OF DAIRYMEN, RELATING TO TESTING MILK AND CREAM.

It is hereby enacted by the General Assembly of the State of Vermont:

Section 1. All bottles, pipettes or other measuring glasses used by any person, firm or corporation, or their agents or employes, at any creamery, butter factory, cheese factory or condensed milk factory, or elsewhere in this State, in determining by Babcock test, or by any other test, the value of milk or cream received from different persons or parties at such creameries or factories, shall, before such use, be tested for accuracy of measurement and for accuracy of the per cent. scale marked thereon. It shall be the duty of the superintendent of the dairy school of the University of Vermont and State Agricultural College to designate some competent person to test the accuracy of such bottles, pipettes, or other measuring glasses. The person thus designated shall so mark such bottles, pipettes, or other measuring glasses as are found correct in marks or characters which cannot be erased, which marks or characters shall stand as proof that they have been so tested; and no incorrect bottles, pipettes or other glasses shall be thus marked. The superintendent of the dairy school shall recieve for such service the actual cost incurred and no more, the same to be paid by the persons or corporations for whom it is done.

Sec. 2. Each and every person, who, either for himself or in the employ of any other person, firm or corporation, manipulates the Babcock test, or any other test, whether mechanical

or chemical, for the purpose of measuring the contents of butter fat in milk or cream as a basis for apportioning the value of such milk or cream, or the butter or cheese made from the same shall secure a certificate from the superintendent of the dairy school of the university of Vermont and State Agricultural College that he or she is competent and well qualified to perform such work. The rules and regulations in the application for such certificate and in the granting of the same shall be such as the superintendent of the school may arrange. The fee for issuing such certificates shall in no case exceed one dollar, the same to be paid by the applicant to the superintendent of the dairy school and to be used by the superintendent in meeting the expenses incurred under this section.

Sec. 3. Any person or persons violating any of the provisions of this act, shall, on conviction in court of competent jurisdiction, be fined not more than twenty-five dollars for the first offense, and not more than fifty dollars for each subsequent offense. It shall be the duty of every sheriff, deputy sheriff and constable to institute complaint against any person or persons violating any of the provisions of this act. and on conviction one-half of the fine shall go to the complainant and the balance to the State.

Approved November 19 1898.

No 82.—AN ACT IN RELATION TO CREAMERIES AND CHEESE FACTORIES AND THE MANAGEMENT OF THE SAME.

SECTION
1. Owners of creameries to deliver to patrons monthly detailed statement.
2. Creameries must weigh, sample and test milk.
3. Owners of cheese factories to deliver to patrons detailed monthly statement.

SECTION
4-5. Owners of creameries to make monthly statement of total receipts of milk and pounds of butter produced.
6. Penalty for neglecting to comply with act.
7. Act takes effect January 1, 1899.

It is hereby enacted by the General Assembly of the State of Vermont:

Section 1. Every owner, operator or manager of a creamery in this State whether co-operative or proprietary, shall monthly make and deliver to each of the patrons of said creamery a statement of the number of pounds of milk or cream such patron delivers for that month, together with the test. pounds of butter fat, gain per cent. from the churn, and actual pounds of butter produced from said milk., and the price paid for the same shall be computed on the actual pounds of butter.

Sec. 2. Any owner, operator or manager of any creamery, whether co-operative or proprietary who sells or other-

wise disposes of any of the milk received at such creamery shall weigh and carefully sample the same and shall test such samples for the purpose of ascertaining the number of pounds of butter fat in such milk sold, or otherwise disposed of, and the gain per cent. which is found to be the gain from the churn for that month shall be the one used in ascertaining the actual number of pounds of butter produced from such milk as is sold or otherwise disposed of.

Sec. 3. The owner, operator or manager of any cheese factory in the State, whether co-operative or proprietary, shall make and deliver to each of the patrons of said factory a statement representing the number of pounds of milk he delivers for each month, together with the test and actual number of pounds of cheese produced by such milk for said month. And the price paid for the same shall be computed on actual number of pounds of cheese.

Sec. 4. Every owner, operator or manager of a ceamery in this State, whether co-operative or proprietary, shall make a statement each month of the total number of pounds of milk received for that month, together with the gain per cent. from the churn, and the actual number of pounds of butter produced from said milk and cream.

Sec. 5. The statement mentioned in the preceding section shall be posted in a conspicuous place in said creameries.

Sec. 6. Any manager or proprietor of any creamery or cheese factory in the State, who after request by any person refuses or neglects foi the space of ten days, to comply with any of the provisions of this act, shall forfeit to said person ten dollars for each refusal or neglect, to be recovered by an action founded on this statute.

Sec. 7. This act shall take effect January 1, 1899.

Approved November 29, 1898.

No. 83.—AN ACT TO REGULATE THE SALE OF CONCENTRATED COMMERCIAL FEEDING STUFFS.

It is hereby enacted by the General Assembly of the State of Vermont:

Section 1. Every lot or parcel of any concentrated commercial feeding stuff, as defined in section three of this act,

used for feeding farm live stock, sold, offered or exposed for sale in the State of Vermont, shall, in addition to the tax tag described in section five of this act have affixed thereunto, in conspicuous place on the outside thereof, a plainly printed statement clearly and truly certifying the number of net pounds of feeding stuff in a package, the name, brand or trade mark under which the article is sold, the name and address of the manufacturer, or importer, the place of manu- and a chemical analysis stating the percentages it contains, of crude protein, allowing one per cent. of nitrogen to equal six and one-fourth per cent. of protein and of crude fat, both constituents to be determined by the methods adopted at the time by the Association of Official Agricultural Chemists; provided that the statement of the percentage of crude fat may be omitted if it does not exceed three per cent.

Sec. 2. The term concentrated commercial feeding stuff, as here used, shall not include hays, and straws, the whole seeds nor the unmixed meals made directly from the entire grains of wheat, rye, barley, oats, Indian corn, buckwheat and broom corn. Neither shall it include wheat, rye and buckwheat brans or middlings, nor pure grains ground together, nor wheat bran or middlings mixed together or with other feeds.

Sec. 3. The term concentrated commecrial feeding stuff, as hereused, shall include linseed meals, cottonseed meals, pea meals, cocoanut meals, gluten meals. gluten feeds, maize feeds, starch feeds, sugar feeds, dried brewer's grains, malt sprouts, hominy feeds, cerealine feeds, rice meals, oat feeds, corn and oat chops, corn and oat feeds, ground beef or fish scraps, similar mixed feeds provenders and all other materials of a nature not included within section two of this act.

Sec. 4. Before any concentrated commercial feeding stuff, as defined in section three of this act, is sold, offered or exposed for sale, the importer, manufacturer or party who causes it to be sold or offers it for sale within the state of Vermont, shall, for each and every feeding stuff bearing a distinguishing name and trade mark file with the director of the Vermont Agricultural Experiment Station a certified copy of the statement named in section one of this act. and shall also deposit with said director, at his request, a sealed glass, jar or bottle containing not less than one pound of the feeding stuff to be sold or offered for sale, accompanied by an affidavit that it is a fair average sample thereof and corresponds within reasonable limits to the feeding stuff which it represents in the percentages of protein and fat which it contains.

Sec. 5. The manufacturer, importer, agent or seller of each concentrated commercial feeding stuff as defined in section

three of this act, shall, before the article is offered for sale, pay the director of the Vermont Agricultural Experiment Station an inspection tax of ten cents per ton for each ton of such concentrated feeding stuff sold or offered for sale in the State of Vermont, and shall affix to each car shipped in bulk and to each bag, barrel or other package of snch concentrated feeding stuff, a tag, to be furnished by said director, stating that all charges specified in this section have been paid. The director of said experiment station is hereby empowered to prescribe the forms for such tags, and adopt such regulations as may be necessary for the enforcement of the law. Whenever the manufacturer or importer or shipper of a concentrated feeding stuff shall have filed the statement made in section one of this act and paid the inspection tax, no agent or seller of said manufacturer, importer or shipper shall be required to file such statement or pay such tax. The amount of inspection tax received by said director shall be paid by him to the state treasurer. So much of the inpection tax collected under this act shall be paid by the state treasurer to the treasurer of said experiment station as the director of said experiment station may show by his bills has been expended in performing the duties required by this act but in no case to exceed the amount of the inspection tax received by the state treasurer under this act, such payment to be made quarterly upon the order of the auditor of accounts, who is hereby directed to draw his order for such purpose,.

Sec. 6. Any manufacturer, importer, agent or person selling or offering or exposing for sale any concentrated commercial feeding stuff, as defined in section three of this act, without the statement required by section one, and the tax tag required by section five of this act, or with a label stating that said feeding stuff contains substantially a larger percentage of either of the constituents mentioned in section one than is contained therein, shall on conviction in a court of competent jurisdiction be fined not more than fifty dollars for the first offense and not more than one hundred dollars for each subsequent offense.

Sec. 7. All manufacturers and importers of concentrated commercial feeding stuffs, or dealers in the same, shall, when requested, furnish the director of the Vermont Agricultural Experiment Station with a complete list of the names or trade marks of said feeding stuff, and all agents selling, offering or exposing the same for sale.

Sec. 8. The director of the Vermont Agricultural Experiment Station shall cause one analysis or more to be made annually of each concentrated commercial feeding stuff sold or offered for sale under the provisions of this act. Said di-

rector is hereby authorized in person or by deputy to take a sample not exceeding two pounds in weight for analysis from any lot or package of concentrated commercial feeding stuff which may be in the possession of any manufacturer, importer, agent or dealer in this state; but said sample shall be drawn in the presence of said party or parties in interest, or their representatives, and shall be taken from a parcel or number of packages which shall not be less than five per cent. of the whole lot inspected, and shall be thoroughly mixed and then divided into two equal samples and placed in glass or metal vessels, carefully sealed and a label placed on each stating the name or brand of the feeding stuff or material sampled, the name of the party from whose stock the sample was drawn, and the time and place of drawing the said label shall be signed by the director or his deputy and by the parties or party in interest, or their representative, present at the drawing and sealing of said samples; one of said duplicate samples shall be retained by the director and other by the party whose stock was sampled, and the sample or samples retained by the director shall be for comparison with the certifiəp statements named in sections 1 and 4 of this act. The result of the analysis of the sample or samples so procured, together with such additional information as circumstances advise shall be published in reports or bulletins from time to time.

Sec. 9. The director of the Vermont Agricultural Experiment Station shall notify the State treasurer of all violations of this act, and the State treasurer shall commence a suit in the name of the State against the party or parties thus reported. It shall be the duty of the treasurer, upon ascertaining any violation of this act, to forthwith notify the manufacturers and importers, in writing, and to give them not less than thirty days thereafter in which to comply with the requirements of this act. But there shall be no prosecution in relation to the quality of any concentrated commercial feeding stuff if the same shall be found to be substantially equivalent to the statement of analysis made by the manufacturers or importers.

Sec. 10. The term importer, for all the purposes of this act, shall be taken to mean all who procure or sell concentrated commercial feeding stuffs.

Sec. 11. All acts or parts of acts inconsistent with this act are hereby repealed.

Sec. 12. This act shall take effect July 1st, 1899.

Approved November 29, 1898.

No. 84.—AN ACT TO PREVENT FRAUD IN THE SALE OF GARDEN SEEDS.

It is hereby enacted by the General Assembly of the State of Vermont:

Section 1. Every package of garden seeds offered for sale in the state of Vermont shall have the year in which they were grown plainly printed thereon.

Sec 2. Any person who offers for sale any garden seeds contrary to the provisions of section 1 of this act or who puts a false date on any package of garden seeds, shall be fined not less than ten dollars for each offense.

Sec. 3. This act shall take effect on the first day of July, 1899.

Approved November 29, 1898.

REPORT OF THE SECRETARY.

Herewith I submit my second annual report for the year ending June 30, 1900.

During the year meetings have been held in all the counties in the state and in more towns than ever before in any one year since the Board was created.

Two weeks of meetings were held in the month of August 1899 with very satisfactory results. At some of the meetings full one thousand attended to hear the Honorable Aaron Jones of Indiana and that noted agriculturalist T. B. Terry of Ohio.

For the winter meetings the Board was assisted by Col. J. H. Brigham, Ass't Sec'y of the Department of Agriculture, Washington, D. C., John Gould of Ohio, and Prof. C. W. Burkett of the New Hampshire agricultural College and the following Vermonters are men of large practical experience, if not scientific, on the subjects they represented. Prof. L. R. Jones, Botanist; Prof. C. H. Jones, Chemist of the State Agricultural College; Hon. Cassius Peck, Supt. aud member of the Board of Control, Hon. W. B. Vial, State Highway Commissioner; Geo. Aitken, President of State Agricultural Socity; R. H. Holmes, President Vermont Bee-Keepers' Association; J. W. Titcomb, Fish Commissioner; Hon. T. L. Kenney, President Horticultural Society; Hon. Mason S. Stone, State Supentendent of Education; Dr. H. D. Holton, Member State Board of Health; George H. Terrill, of the Small Fruit Growers' Association; L. B. Harris, of the New England Sheep Breeders' Association; D. H. Morse, Randolph; C. F. Smith, Morrisville; Ernest Hitchcock, Pittsford; C. A. Chapman, Ferrisburgh; and T. B. Harriot, of Georgia.

On several occasions the audience has been pleased to welcome the Governor of the state and hear from him words of encouragement.

Meetings have been held in forty-three towns during the year, their location will be hereafter named. I will also call your attention to a map upon another page showing the different sections where meetings were held.

FARMERS' MEETINGS.

Morrisville,	August 22, 1899
South Hero,	August 23,
Rutland	August 24,
Burlington,	August 25,
Williamstown,	August 29,
Randolph,	August 30,

Springfieldd,	August 31, 1899
Jacksonville,	Septmber 1,
Irasburg.	December 18 and 19,
Brownington Centre,	December 20 and 21,
Sutton,	December 21 and 22,
Manchester Center,	January 1 and 2, 1900
South Shaftsbury,	January 3,
Salisbury,	January 4,
Vergennes,	January 4 and 5,
Grafton,	January 11 and 12.
Vernon,	January 15 and 16,
Westminster,	January 16 and 17,
Hartland,	January 17 and 18,
West Fairlee,	January 18 and 19,
Cavendish,	January 22 and 23,
Cuttingsville,	January 23 and 24,
Chittenden,	January 24,
Cornwall,	January 25 and 26,
Brandon,	January 25 and 26,
East Topsham,	January 29 and 30,
Washington,	January 30 and 31,
West Concord,	February 1 and 2,
Franklin,	February 6 and 7,
Sheldon,	February 7 and 8,
Georgia,	February 8 and 9,
East Hardwick,	February 12 and 13,
Craftsbury,	February 14,
Elmore,	February 15.
Stowe,	February 16,
Jeffersonville,	February 19 and 20,
Westford,	February 20 and 21,
Waterbury Center,	February 21 and 22,
South Royalton,	February 23,
East Calais ,	February 26 and 27,
Ryegate,	February 28 and March 1,
Peacham,	March 1,
Castleton,	March 7,

SUBJECTS DISCUSSED BY THE SPEAKERS.

Col. J. H. Brigham, Assistant Secretary of Agriculture, Washington, D. C., National Agriculture; The Work of the Department of Agriculture; Suggestions for Ambitious Boys,

T. B. Terry, Ohio; Corn and Potato Cultivation; The Wife's Share; Growing Good Crops in a Dry Season.

Hon. Aaron Jones, Master of the National Grange; National Agriculture, Transportation, Farmers' Organizations.

Prof. C. W. Burkett; New Hampshire, Soil; Stock Breeding, Agricultural Colleges.

John Gould, Ohio, Individual Types of Dairy Cows; Soils; The Men Farmers Meet; Changes in Feeding the World; Birds; Silos and Silo Building.

Prof. J. L. Hills, Member of the Board, Some of the Newer Ideas in Agriculture; The Man With the Hoe; Proverbs 27: 23; The Agricultural College and Experiment Station, Its Objects and Work; Science in Agriculture.

J. K. Curtis, Member of the Board, Farm Barns; Our Forage Crops; Silos and Corn Growing; Road Making; The Grass Crop.

Prof. L. R. Jones, Grasses; Weeds; Spraying Vines; and Trees.

Prof. C. H. Jones, Fertilizers.

Hon. Cassius Peck, The Working of the Agricultural College Farm.

Hon. W. B. Viall, Roads and Road Making.

George Aitken, Soils; Fertilization; Stock Breeding.

R. H. Holmes, Bee Culture, and the Industry in Vermont.

J.W. Titcomb, Fish Culture (Illustrated by a stereopticon.)

T. L. Kenney, Commercial Fruit Growing.

Mason S. Stone, The Education of the Farmer.

Dr. H. D. Holton, Farm Sanitation.

George H. Terrill, Bees; Fruits and Vegetables; The Dairy Cow, Her Care and Feed; Farm Fertility.

L. B. Harris. Sheep Raising in Vermont.

D. H. Morse, The Grass Crop; Farm Help.

Ernest Hitchcock, Farm Barns; Forestry.

C. F. Smith, Dairying for Profit; Breeding and Feeding; Farm Fertility; Soils; Clover and Ensilage.

C. A. Chapman, Wool and Mutton.

T. B. Harriott, Vermont Cheese.

There seems to be increased interest in farming. Dairying is the leading industry and is carried on more or less in every town in the state.

The co-operative creamery and cheese factory have a tendency to increase the size of the dairies, the average dairyman procuring better quality and price for his product by having an experienced man to handle the cream and manufacture the butter. The growing of wool and mutton is again on the increase, and it is hoped that the sweet grasses of many more of our hill pastures will be used in growing the Shropshire, the South Downs, the Cotswolds or the Spanish Merino.

Vermont should again pay much more attention to the

raising of horses. If her past record has not been well maintained of late, there is no reason why it cannot be fully regained. The world at large is demanding at good prices just the kind of horses she is able to produce.

The maple sugar industry has suffered much in the past two or three years, owing to the forest worm and also to natural causes. reducing the yield fully 35 per cent. each season. The plague having been removed another season may bring us a good crop.

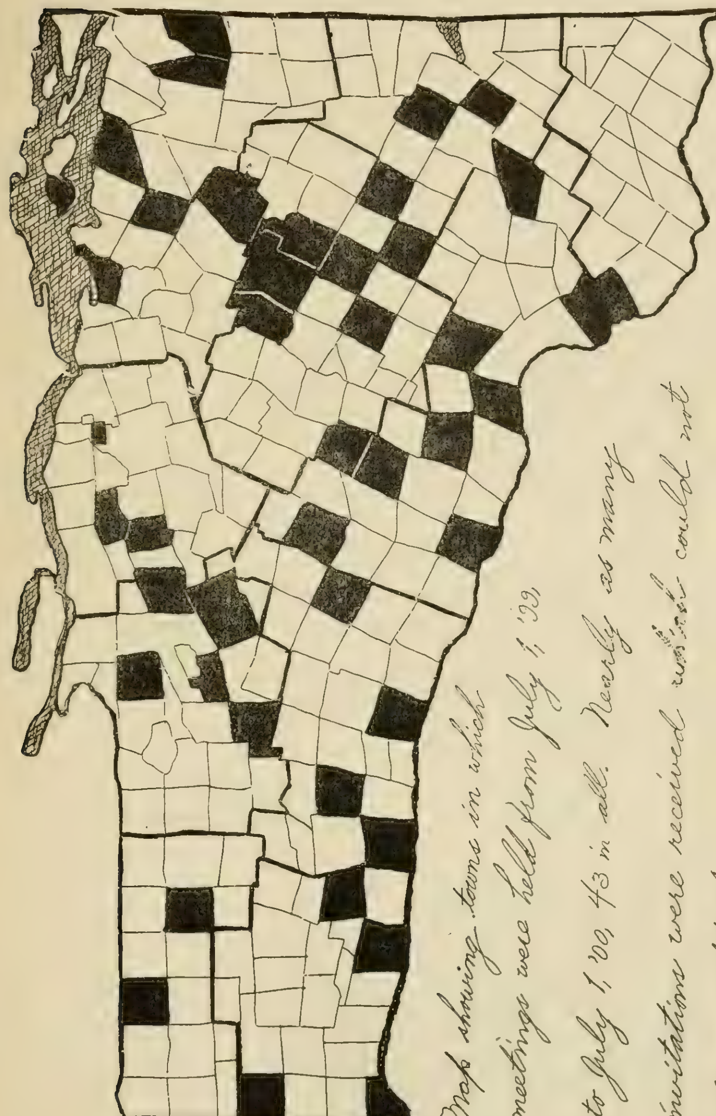
While many maple trees have been killed, but few sugar places as a whole have been destroyed.

Vermont farmers are improving in their methods and while farm laborers are not to be found in an abundant supply, with the aid of improved machinery, the acreage of cultivated crops is increasing from year to year.

Following will be found a list of organizations that are working in the interests of agriculture.

CATTLE COMMISSION: The work of the Board as Cattle Commissioners will be found under a separate head.

C. J. BELL, Secretary.



Map showing towns in which meetings were held from July 1, '99, to July 1, '00, 43 in all. Nearly as many invitations were received which could not be accepted.

ASSOCIATIONS.

State Agricultural Society—President, George Aitken, Woodstock; Secretary, C. M. Winslow, Brandon; Treasurer, J. Walter Parker, Quechee.

Vermont Dairymen's Association—President, M. A. Adams, Derby; Secretary, F. L. Davis, No. Pomfret; Treasurer, P. W. Strong, No. Pomfret.

Vermont Maple Sugar Makers' Association—President, V. I. Spear, Randolph; Secretary, A. J. Croft, Enosburg Falls; Treasurer, Alpha Messer, Rochester.

Vermont Jersey Cattle Club—President, Homer W. Vail, North Pomfret; Secretary and Treasurer, T. G. Bronson, East Hardwick.

The Vermont Merino Sheep Breeders' Association—President, Ira L. Hamblin, Middlebury; Secretary, Lewis A. Skiff, Middlebury; Treasurer, Lewis A. Skiff, Middlebury.

State Horticultural Society—President, T. L. Kinney, So. Hero; Secretary, F. A. Waugh, Burlington; Treasurer, F. A. Waugh, Burlington.

Vermont Botanical Society—President, Prof. Ezra Brainard, Middlebury.; Secretary, Prof. L. R. Jones, Burlington.

Vermont Bee Keepers' Association—President, R. H. Holmes, Shoreham; Secretary, M. F. Cram, West Brookfield; Treasurer, H. L. Leonard, Brandon.

Green Mountain Cotswold Sheep Association—President, Frank Phillips, Glover; Secretary and Treasurer, A. A. Niles, Morrisville.

Vermont Shropshire Sheep Association—President, George H. Terrill, Morrisville; Secretary and Treasurer, A. A. Niles, Morrisville.

OFFICIAL DIRECTORY, VERMONT STATE GRANGE. PATRONS OF HUSBANDRY, 1900.

OFFICERS.

Master—C. J. Bell, East Hardwick.
Overseer—C. F. Smith, Morrisville.
Lecturer—R . B. Galusha, Jericho.
Steward—D. H. Morse, Randolph.
Assistant Steward—M. B. Roberts, Rupert.
Chaplain—O. J. Lowrey, Jericho.
Treasurer—F. B. Pier, Rawsonville.
Secretary—A. A. Priest, Randolph.
Gate Keeper—A. F. Lawrence, St. Johnsbury.
Ceres—Mrs. C. J. Bell, East Hardwick.
Pomona—Mrs. C. F. Smith, Morrisville.

Flora—Mrs. R. B. Galusha, Jericho.

Lady Assistant Steward—Mrs. M. B. Roberts, Rupert.

Executive Committee—D. H. Morse, Randolph; W. L. Park, Lyndon; I. T. Story, Essex; F. H. Spaulding, West Brattleboro; Master and Secretary *ex officio*.

MASTERS OF POMONA GRANGES.

1. Chittenden County—Arthur Morgan, Master, West Milton.
2. Shepherd—Jesse Gage, Master, St. Johnsbury.
3. White River Valley—J. W. Waldo, Master, South Royalton.
4. Allen District—E. F. Whitcomb, Master, Springfield.
5. Windham County—W. E. Banks, Master, Brattleboro.
7. Central Vermont—Henry Kibbee, Master, No. Randolph.
8. Washington—J. H. Sheldon, Master, Dorset.

SUBORDINATE GRANGES, 1900.

1. Green Mountain, St. Johnsbury Center—L. W. Gray, Master, Lyndon.
9. Caledonia, East Hardwick,—W. L. Dow, Master.
16. Enterprise, Lyndon—C. A. Hoyt, Master.
22. Protective, Brattleboro—Carl S. Hopkins, Master, Western Avenue.
23. Independent, Wheelock—Bradley Ingalls, Master, Sheffield.
53. White River, Royalton—J. F. Shepard, Master, So. Royalton.
66. Wide Awake, St. Johnsbury Center—F. I. Brewer, Master.
80. Middlesex, Montpelier—J. P. Flint, Master.
81. Williamstown, Williamstown—H. W. Davis, Master.
83. Orion, South Woodstock—E. A. Fullerton, Master.
87. North Branch, Worcester—H. T. Kellogg, Master.
93. Snowville, East Braintree,—C. L. Smith, Master.
98. Brookfield, Brookfield—H. C. Kibbee, Master, No. Randolph.
114. Springfield, Springfield—Chas. F. Cluff, Master.
117. Grafton, Grafton—Solon Cummings, Master. Houghtonville.
118. West River, Townshend—G. H. Houghton, Master.
127. Industrial, Andover—S. P. Carleton, Master, Simonsville.
128. Williams River, Chester—Edward Batchelder, Master.

129. South Branch, Chester—E. A. Edson, Master.
131. West Branch, Landgrove,—L. F. Woodward, Master.
137. Farmers, South Londonderry—E. S. Davis, Master.
138. Mountain Home, Bondville—J. M. Kendall, Master.
139. Vermont, Wardsboro—S. D. May, Master.
142. Floral, Sharon—H. C. Bruce, Master.
151. Broad Brook, Guilford Center—M. A. Thomas, Master, Guilford.
154. Evening Star, Dummerston—F. L. Stark, Master.
155. Essex Center, Essex—I. T. Story, Master, Essex Center.
156. Maple Grove, West Westminster—Joseph P. Ranney, Master.
157. Boyden, Westminster -J. W. Collins, Master.
158. Middle Branch, East Bethel—Vernon Brown, Master, South Royalton.
159. Dog River Valley, West Berlin—W. E. Colby, Master.
163. Guiding Star, West Halifax—Eli S. Cook, Master.
164. Victory, Wilmington—Edward Titus, Master.
165. North River, Jacksonville—G. H. Coleman, Master.
170. Mount Mansfield, Underhill—A. C. Humphrey, Master.
228. Vernon, Vernon—A. J. White, Master, Dummer.
229. West Randolph, Randolph—G. C. Flint, Master.
230. Mount Anthony, Rupert—J. F. Sheldon, Master, West Rupert.
231. Dorset, Dorset—Mrs. H. E. Snyder, Master.
233. Lamoille, Morrisville—Harrison Dodge, Master.
237. Waterbury, Waterbury Center—George Chapin, Master.
239. Westford, Westford—John E. Allen, Master.
240. Neshobe, Brandon—T. C. Seager, Master.
242. Pleasant Valley, Rockingham—W. H. Mack, Master.
244. Memphremagog, Newport—W. L. Barrows, Master, Coventry.
246. Newport Center, Newport Center—W. R. Connal, Master.
247. Rising Star, Bethel—Scott Gillette, Master.
249. Woodlawn, West Milton—Olin McNall, Master.
252. Sutton, Sutton—L. W. Gordon, Master.
253. State Line, South Vernon—A. A. Martindale, Master, West Northfield, Mass.
254. Silver Leaf, Fairlee, F. W. Pierce, Master.
255. Eclipse, Thetford—F. M. Bond, Master.
257. Missisquoi Valley, Troy—D. A. Ball, Master.
260. Clover Leaf, Bradford—A. F. Johnson, Master.

261. Pulaski, Newbury—A. W. Silsby, Master.
262. Mayflower, South Fairlee—L. B. Morse, Master.
263. Blue Mountain, Ryegate—T. A. Meader, Master.
266. Pleasant Valley, West Waterford—E. P. Carpenter, Master.
267. Marshfield, Marshfield—S. C. Pike, Master.
268. Washington, Washington—J. B. Seaver, Master.
269. Craftsbury, Craftsbury—E. A. Dutton, Master, East Craftsbury.
270. Maple Valley, Albany—J. B. Rogers, Master.
271. Irasburg, Irasburg—J. H. Cook, Master.
272. Glover, Glover—Hiram N. Davis, Master.
273. Bomoseen, Castleton—L. N. Benedict, Master.
274. Stowe, Stowe—G. S. McAllister, Master.
275. Cavendish, Cavendish—L. M. Allen, Master.
276. Ludlow, Ludlow—E. W. Johnson, Master.
277. Dunmore, Salisbury—C. A. Bump, Master.

LIST OF FAIRS, STATE OF VERMONT, 1900.

Vermont State Fair Billings Park, White River Junction. President, Geo. Aitken; Secretary, N. P. Wheeler; Treasurer, Alfred E. Watson. Date, September 11-14.

Battenkill Valley Industrial Society, Manchester Centre (County). President, E. B. Smith; Secretary, D. K. Simonds; Treasurer, W. H. Roberts; September 5-7.

Bradford Agricultural and Trotting Association (County). President, F. O. Kennedy; Secretary, N. W. Cunningham; Treasurer, B. S. Hooker. August 28-29-30.

Orwell Farmers' Club, Orwell (Local). President, E. D. Griswold; Secretary, H. D. Branch; Treasurer, E. M. Bottom. Date not decided upon.

Brandon Fair Association, Brandon (World). President, H. R. C. Watson; Secretary, C. E. Savery; Treasurer, W. C. Fletcher. Date not decided upon.

Caledonia Grange Fair, East Hardwick (Local). President, C. J. Bell; Secretary and Treasurer, E. B. Fay. September 29.

Rutland County Agricultural Society, Rutland, (County). President, H. O. Carpenter; Secretary, C. C. Pierce; Treasurer, F. A. Field. September 11-13.

Ryegate and Wells River Valley Dairymen's Association, South Ryegate, (World). President, Dr. Geo. W. Darling; Secretary, F. J. Tewksbury. Treasurer, F. R. McColl. August 29-30.

Western Vermont Agricultural Society, Fair Haven, (Local) President, B. H. Norton; Secretary, and Treasurer, E. N. Northrop. August 28-31.

Dog River Valley Fair Association, Northfield, (World). Presi-

dent, J. B. Wells, Randolph; Secretary, W. W. Holden; Treasurer, James Morse. September 18-20.

Caledonia County Fair Ground Co., St. Johnsbury. President, T. R. Stiles; Secretary, Charles Smith, McIndoe Falls; Treasurer, H. H. Carr. September 11-13.

Windsor County Agricultural Society, Woodstock. President, Horace C. Lockwood; Secretary, John S. Eaton; Treasurer, Chas. H. English. September 25-27.

Valley Fair Association, Brattleboro, (World). President, Geo. W. Hooker; Secretary, C. L. Stickney; Treasurer, J. J. Estey. September 26-27.

Addison County Agricultural Society, Middlebury. President, Darwin Rider; Secretary, Chas. S. Dana, New Haven; Treasurer, Alfred P. Roscoe, New Haven. September 5-7.

Waits River Valley Agricultural Society, East Corinth, (World). President, James R. McLam, Topsham; Secretary, Rev. E. W. Hatch, East Corinth; Treasurer, E. R. Corliss. September 5-7.

Lamoille Valley Fair Ground Co., Morrisville. (County) President, Geo. W. Hendee; Secretary, A. A. Niles; Treasurer, Geo. W. Hendee. September 5-7.

Winooski Valley Agricultural Association, Waterbury, (World). President, G. E. Moody; Secretary, M. O. Evans; Treasurer, W. V. Bryan. September 11-13.

Northern Caledonia Fair Association, Lyndonville, (part of County). President, C. M. Darling; Secretary, E. McGinnis; Treasurer, Robert Child. September 19-20.

Washington Agricultural Association, Washington, (World.) President, A. T. Newman; Secretary, M. W. Chamberlain; Treasurer, G. E. Huntington. September 25-27.

Springfield Agricultural Society, Springfield. President, L. M. Cragin; Secretary, R. W. Whitney; Treasurer, G. F. Leland. September 5-6.

Orleans County Fair Association, Barton, President, H. H. Somers, Irasburg; Secretary, D. D. Beane; Treasurer, O. D. Owen. September 11-13.

Union Driving Park Society, South Wallingford, (Local). President, C. A. Claghorn; Secretary, G. A. Hadwin; Treasurer, E. A. Fuller. Date not decided upon.

Union Agricultural Society Tunbridge (World). President J. K. Darling, Chelsea; Secretary, W. W. Swan, No. Tunbridge; Treasurer, H. R. Hayward. October 2-4.

Franklin County Fair, Sheldon.

THE OLD AND NEW IN FARMING.

BY LUNA SPRAGUE PECK.

There are many vital questions
For the farmer of to-day,
Bearing radical suggestions,
Foreign to the good old way.

Conservative, and loth to change,
Oftimes he views askance,
The innovations new and strange
That scientists advance.

The acres that he proudly tills
Are those his grandsire cleared
His sire rebuilt smoothed vale and hills,
And sons and daughters reared.

And both were honest, fearing God
With frugal ways content,
They wrested from the well turned sod
The dollars saved and spent.

And so he argues, that the way
Their competence was won,
Is good enough for him to-day
And suited to his son.

And if the world were standing still
And life a stagnant sea,
No breath to stir the sails, until
All life had ceased to be.

Progressive Arts might be refused
And farmers reap and sow
With implements that farmers used
A hundred years ago.

With wooden plow, and weary arm
He still could turn the sod,
And feel the wooden harrows charm
Each footsore mile he trod.

His grain from out a wooden pail
Sow broadcast o'er the land
Then thresh it with a wooden flail
And winnow it by hand.

But since howe'er the billows break
Progress' brave ship sails on
Farming must in it passage take,
Or breast the waves alone.

All other occupations are
Aboard this craft so wide
And watching eager from afar,
The turning of the tide.

Greedy to reach and make their own
Before the voyage is o'er,
The flotsam and the jetsam throw
Upon the waiting shore.

Book farming long has been a term
Expressive of derision,
Repeated failures but confirm
And strengthen this decision.

Half truths, half taught, the primal cause,
For this misapprehension,
For the practical a limit draws
To theory's pretension.

But if experimental lore
Will cause two blades to grow
Where only one has grown before
Its worth awhile to know.

If worn out soils new vigor gain
Through scientific aid
And bugs and worms greet life in vain
And blight and rust are stayed.

Seeing, the farmer will believe
Nor longer will deride,
Think for himself, but gladly leave
False prejudice and pride.

The idea has passed forever
That brainless grinding toil
Is the all-controlling lever
For the tiller of the soil.

For machinery is King to-day
With sovereign aid to lend,
And best of all has come to stay,
The farmer's loyal friend.

For a time, from competition
With the new lands of the west,
Loaded with their rich fruition—
Eastern markets were depressed.

Low prices ruled farm products, and
We viewed with vague alarm,
Depreciation in the land
And the abandoded farm.

Double taxation on real estate.
Was added to the pack
That needek but a feather's weight
To "break the camel's back."

The first wrought havoc with the hour
The *last* is with us still
A serpent in whose venomed power,
Men writhe, but dare not kill.

And what about the farmer's wife,
Is her world standing still ?
With changes wrought in farm-house life
By factory and mill ?

The busy hum of spinning wheel
The wool, and flax and tow
The clumsy loom, the swifts and reel
Were banished long ago,

Machines for almost everything,
Modern improvements, too,
Relieved of all the dairying
What does she find to do.

Well then, just try it if you think
More leisure life bestows,
Prepare the food we eat and drink,
Keep house and home and clothes.

Assist the children, keeping pace
With each and every grade,
They're overcrowded in the race
And need strong, patient aid.

Church work and missionary aids,
Auxiliaries and clubs,
Attend receptions, dress parades
'Round all the social hubs.

The O. E. S., I. O. G. T.,
W. C. T. U., C. E.,
The P. of H. and W. R. C.,
Y. W. C. A., K. D.

So round and round the "causes" roll
A never ending ball
Which brings to mind a dear good soul
Who joined and loved them all.

And fearing in her anxious care,
Someone she might forget,
Devised this comprehensive prayer,
"Lord bless the alphabet."

Turn all the wheels, without, within
And Grandma's life will seem
With time to knit and weave and spin—
A sweet pastoral dream.

Horizons broaden, those who view
The twentieth century's dawn,
Gaze farther out, where old and new
Blend, ere the old is gone.

And dimly see adown the years
The earlier century's birth,
Whose sturdy farmer pioneers
Of brave, heroic worth—

Gave to New England, acres tilled—
And all its vaunted good,
It owes the men who dared to build
The log house in the wood.

Oft we wonder at their doing
And the courage they displayed,
'Gainst all odds their way pursuing,
Facing red men undismayed.

And regretting, conscience smitten,
Tameness that our life employs,
Fain would have our pages written,
Like the first "Green Mountain Boys."

Seeing not, in growth's deep-rooted
Springing thick around our way,
Foes as crafty and sure footed
As the foes of yesterday

But the times have not bereft us
Of the valor of those years,
That as heritage was left us
By those honored pioneers.

And mayhap, who tells the story
As this century recedes,
May discern some hidden glory
In the record of our deeds.

AGRICULTURAL PROGRESS DURING THE LAST THREE DECADES.

By COL. J. H. BRIGHAM, Asst. Sec'y, Dept. Agri. U. S.
Delivered at Cavendish; January 23.

Within the last twenty or thirty years great progress has been made in the agriculture of this country, both in science and practice. To this advancement the Department of Agriculture has contributed in no small degree. Before the civil war the work of the government in aid of agriculture was very limited, occupying a small space in the Department of the Interior. In 1862 Congress passed a bill creating an agricultural department as an independent organization. The total annual expenditure for maintaining the Department at that time did not exceed $20,000. To-day it employs nearly 3000 persons and requires an appropriation of more than $3,000,000 annually.

It was elevated to an executive department in 1889, when its work had grown into thirteen divisions. At present there are twenty divisions, including the Weather Bureau, which was transferred from the War Department to the Department of Agriculture in 1891.

BUREAU OF ANIMAL INDUSTRY.

The advancement of agriculture is specially shown in the progress made in checking and eradicating contagious diseases among our farm animals and in the discovery of remedies therefor. When in 1894 the cattle raisers of the country, having become alarmed over the rapid spread of pleuro-pneumonia and Texas fever, demanded that some steps be taken by the Government, Congress passed a bill creating the Bureau of Animal Industry. The Bureau began its work by the study of means and methods for eradicating the disease. The "stamping-out process" was decided upon as the most efficacious, and on March 25, 1892, the last case disappeared from the United States. Not a single case has since been reported. Texas fever has been assiduously studied and while no remedy has been found, partial success has been accomplished by dipping cattle to destroy ticks, and an effective quarantine has been established which separates the infected areas from non-infected areas. Similar regulations for restricting the spread of sheep scab have been established.

No diseases among domestic animals have worked such havoc as hog cholera and swine plague. It is estimated that Iowa alone suffers to the extent of $15,000,000 annually.

The bureau has discovered a serum which in herds inoculated has resulted in saving from 75 to 80 per cent. of the herds. In 1896 the Bureau set to work preparing a vaccine which would produce immunity from blackleg, a disease which in some states caused greater mortality than all others combined. In 1898 this vaccine was distributed extensively, and reports covering 127,000 herds of cattle show that the loss of animals after vaccination has been reduced to 0.54 per cent., whereas previous to that time it was about 14 per cent.

The inspection of animals for export is one of the most important features of the work of the Bureau. So perfect has this become that it is possible to trace the history of any animal to the farm whence it came. In 1898 there were 418,694 cattle inspected and sheep to the number of 174,000. The establishment of quarantine stations at the principal seaports of this country has resulted beneficially and the inspection of vessels engaged in transportation of live stock has caused a reduction in the insurance rates on cattle from $8 to $1per head.

The work of general meat inspection has grown wonderfully in the nine years of its existence. In 1892 the number of animals inspected before slaughter was 3,809,459; in 1899 it was 34,405,973. The microscopic inspection of pork has increased from 38,152,874 pounds in 1892 to 108,928,195 pounds in 1899.

EXPORTS.

Twenty years ago our Agricultural exports were valued at $550,000,000. At present they are close to $850,000,000, an increase of $300,000,000. The extent of this development can be better appreciated when it is remembered that our home requirements have been increased by the addition of 30,000,000 people who have also been supplied.

It is in the live stock product that our exports have shown the principal gains. Breadstuffs were exported almost as extensively twenty years ago as at present, as was also tobacco. Cotton is sent abroad in larger quantities than formerly, but for several years past the reduced price left little increase in the total value. With present good prices the value will show great increase. Meat exports rose in value from $125,000,000 twenty years ago to about $175,000,000 in 1899, a gain of $50,000,000. Our shipments of live animals increased from $10,000,000 to nearly $40,000,000. This gain suggests greater possibilities in live stock exportation under the improved transportation facilities of the present day. Our exports of fresh beef increased from $5,000,000 to about $25,000,000, and with the further introduction and perfection of refrigerator service on ocean steamships an important development of this export trade can be confidently expected.

STATISTICAL INFORMATION.

In the year 1870 the number of farms in the United States was 2,660,000; in 1890 it was 4,560,000 and they number to-day about 5,000,000, with a total acreage of about 700,000,000, an increase of 400,000,000 acres since 1850. The improved acreage has increased from 113,000,000, in 1850 to 358,000,000 in 1890. From 1850 the average size of farms decreased from 203 acres to 137 acres. Medium-sized farms grew in number from 1880 to 1890 at the expense of the smaller and larger farms, which seems to indicate that medium-sized farms operated by the proprietor and his family with improved farm machinery are the most profitable.

TENANT FARMING.

Farm tenancy has increased in the last two decades. Many reasons are assigned for this. There has been an increase in the urban population from 3 per cent. in 1790 to 12½ per cent. in 1850, to 21 per cent. in 1870 and over 29 per cent in 1890. Perhaps it is now 35 per cent. of the entire population, and it is probable that in the drift of farming population to town and city, farm owners have been unable to find purchasers and have leased their farms. It is suggested also that the allurements of town life and industrial occupations have taken farmers' sons away from the farm so that when the owners have died or given up farming many farms have naturally passed into the possession of tenants. Thousands of emigrants come here annually hungry for land to till. They are usually without money and are unfortunately satisfied to become tenants. Whatever explanation may be made, it is to be borne in mind that the increase of farm tenancy represents an upward movement in the condition and prospects of a large element of our population, which is thus able to acquire farm proprietorship instead of being mere farm laborers.

The real estate value of farms has increased more than ten billion dollars while the value of farm products and live stock has increased more than five billion dollars. In 1893 there were 16,000,000 horses on the farms of this country, an increase of almost 11,000,000 since 1850. Since 1893 there has been a decrease because of the almost complete extinction of the demand for horses for street car service and the increased application of steam and other power to the transportation of freight. Mules have also increased in number, but for the same reasons as that regarding horses, they have decreased within recent years.

The growth of dairy interests is shown by the fact that in 1850 there were 6,000,000 milch cows on the farms and 16,000,000 in 1899, their value increasing from $280,000,000 to

$474,000,000. Cattle have increased enormously in number. There were about 11,000,000 in 1850 and in 1899 there were 28,000,000, their value almost doubling in the last twenty years, being now nearly $650,000,000. There has been a substantial increase in the number of swine, and notwithstanding some drawbacks, sheep have been increasing in both number and value. The actual estimated value of sheep since 1880 has been from $100,000,000 to $108,000,000. The value of horses, mules, cattle, sheep and swine increased in the aggregate from one and a half billion dollars to two billion dollars since 1880.

If an inference may be drawn from the statistics of the Department, it is apparent that milch cows and other cattle have been of more importance to the farmer than other farm animals have been. The average value of milch cows increased more than $6 in twenty years and the average value of other cattle increased $7, while the average value of horses and mules declined and that of sheep and swine remained stationary, although from 1880 to 1899 sheep increased from $2.21 to $2.75 and swine from $4.28 to $4.42. The wool product has increased from 36,000,000 pounds in 1840 to 100,000,000 pounds in 1870, and in 1890 it was 165,000,000.

Notwithstanding the growth in number of creameries, the farm production of butter in 1850, 3,000,000, pounds was multiplied by more than three in 1890, when the production was one billion pounds. Cheese on the other hand has shown a marked decline on the farm, the decline being from 106,000,000 pounds in 1850 to 19,000,000 pounds in 1890. The output of factory however shows progress.

Domestic fowls known as chickens increased more than 150 per cent. from 1880 to 1890; other fowls increased perceptibly, and the number of eggs sold almost doubled.

Indian corn has become a crop of stupendous proportions and now reaches the magnitude of more than two billion bushels annually, or six times the crop of 1840 and three times the crop of 1870. The area devoted to this crop has increased from 4,000,000 acres in 1866 to about 80,000,000 acres in recent years, and the crop increased in value during this time from $411,000,000 to about $550,000,000 in recent years.

The wheat crop of the United States for 1899 is reported at 547,000,000 bushels, or 12 3-10 bushels per acre. The production of some of the recent years has been above this figure, but that of 1840 was only 85,000,000 bushels and that of 1870 only 288,000,000 bushels. The area devoted to wheat has inceased enormously and at the present amounts to about 300 per cent. of the acreage of 1866. During this time the value

of the wheat crop has increased from $232,000,000 to $393,-000,000.

In the production of wheat this country leads all other countries. A comparison for 1898 shows that we produced in the United States 675,000,000 bushels, while in France there were produced 372,000,000 and in Russia 405,000,000. In the whole of Asia there were but 421,000,000 bushels grown. This country is also foremost in the production of cotton, which has had a remarkable growth in dimension, reaching in 1897 nearly 11,000,000 bales, valued at about $320,000,000. The annual hay crop is now worth but $400,-000,000; the potato crop nearly $100,000,000 while the crop of oats is worth from $150,000,000, to $200,000,000, all showing a decided increase.

The introduction of improved farm machinery has contributed greatly to the ability and facility of farmers in planting and harvesting their crops and has reduced the cost of production in a great degree.

SOILS.

There has been a marked general improvement in the management of soils. They are intelligently cultivated and in the southern states methods for preventing erosions and washing of lands has been adopted, while in New York, Pennsylvania, Ohio, Illinois, Indiana, Iowa, and Missouri there has been an increased amount of land underdrained. Many of the light sandy truck soils of the American Coast States are being underdrained in order to dry the, lands more quickly in the spring and hasten the maturity of the plant upon which the value of the crop depends.

In Massachusetts, New Jersey, Wisconsin and Florida partcularly a beginning has been made in some irrigation plants to control the soil moisture conditions in order to prevent the disastrous effect of drouth and so act as an insurance against loss in the destructive summer droughts that are likely to occur in what has always been regarded as the humid regions. In addition to this the practice prevails, in Florida and some other states in the cultivation of pineapples, citrons fruits and tobacco, of shading the land with lath screens, giving half shade, or with canvass to protect the land from undue evaporation, to protect the plants and make the condition of the soil and air more uniform than any other system of cultivation has ever attained.

The most important advance being made now is in the recognition of the influence of the character of the soil upon the distribution and development of the crops. The domains of geology, chemistry, physics and meterology are being in-

vaded and their methods used in studying the origin of soils and their chemical and physical properties and conditions.

Methods have been perfected for surveying and mapping the areas of the different soil formations and soil maps are now being prepared similar to the geological maps, but showing the area and distribution of the soils. The influence of the chemical and physical properties of the soils thus mapped on the character and development of vegetation is very striking and is going to be one of the most important helps that the intelligent farmer could wish to have. Many an area will now be relieved of the suspicion of poor farming when it is shown that the conditions are not suited to the crops raised, and many an area so conditioned will be put to better use and find much more prosperous lines in other crops better adapted to the soil.

In the arid West the soil survyes include the mapping of the alkali conditions. The maps show the depth of standing water and the necessity for underdrainage. They show the accumulation and distribution of alkail salts. indicate what correctives, if any, can be used, and show where underdrainage is necessary to reclaim abandoned lands or to protect against further injury from seepage waters and from alkali. The investigations show that much of the trouble in the rise of alkail comes from the seepage from irrigation canals, rather than from over-irrigation by the farmers. The soil investigations in connection with the alkali work are of the greatest interest and of great value to the irrigation farmer.

AGRICULTURAL CHEMISTRY.

The science of chemistry has been particularly active in aiding scientific agriculture during the past three decades. Since the time of Liebig the science of agrcultural chemstry has been raised on a firm foundation of scientific fact, so that the progress that has been attained is a real one and not simply an evolution of error. The most striking feature of this progress has been the development of artificial fertilization of plants. Practically the whole system of commercial fertilization, as far as its preparation and application are concerned, is the product of the past thirty years. During that period the methods of preparing and applying the vast deposits of phosphates have been discovered and elaborated. Thirty years ago the presence of natural phosphates in the United States was scarcely known. At the present time it is known that this country possesses the most extensive depoists of natural phosphates in the world and the industry of mining, preparing and marketing those phosphates has become an enormous one. The service which chemistry has rendered to agricul-

ture in this particular can scarcely be measured in dollars and cents. Not only is the present supply of this important plant food, represented by phosphate deposits, secured, but our supply for the future for an indefinite period is assured.

In the same line immense progress has been made in the conversion of waste materials for fertilization purposes. Thirty years ago the value of cottonseed was almost unknown, and quite so for fertilizing uses. To-day by reason of chemical research, every ton of cottonseed cake after the expression of the oil, is worth from fifteen to twenty dollars for fertilizing purposes alone.

In like manner the utilization of the waste products of the slaughter house have resulted in the greatest benefit to agriculture. The bones, blood and refuse material of all kinds, with the exception of the oil, (which has no fertilizing value) are now carefully preserved and prepared for utilization on the fields.

In this way not only is phosphatic plant food secured, but also that much more important one, nitrogenous plant food. The development and utilization of the potash mines of Germany have been practically all accomplished during the period mentioned. Unfortunately the only source of potash now known for commercial purpose as a fertilizer is the German deposits. While geological conditions would lead us to expect similar deposits in this country, they have not yet been discovered. Fortunat.ly the German deposits are of such magnitude as to give ample assurance even in the far distant future, that the supply of potash will be sufficient to restore the unavoidable losses which takes place, even with the most careful cultivation.

Another line in which great progress has been made in the last thirty years has been the discovery and study of the ferments which exist in the soil, through which organic nitrogenous materials are converted into forms suitable for plant food and whereby the free nitrogen of the air is assimilated and prepared for further economical uses. We now know with definiteness the various steps which are accomplished in the destruction of organic nitrogenous matter in the soil, and and the conversion of the nitrogen therein contained into nitric acid, the assimilation of the nitric acid by the plant and its evolution into new organic forms, composing some of the most important organs of the plant, suitable in turn for the nutrition of animals. The progress which has been made in this direction alone, if chemistry had done nothing else for agriculture, would be a crowning glory for chemical science.

In the manner of scientific and economical feeding of animals, chemistry has done much to 'promote the science of

agriculture. It has been demonstrated that there is a certain balance in the character of animal food, which when secured gives the greatest efficiency to each component thereof. Chemical invstigation has pointed out the character of the ration which should be employed for the various kinds of domestic animals — for those engaged in hard labor, as well as for those simply to be fattened. It is not extravagant to say that where the principles of scientific feeding are thoroughly understood and carried out, the cost of animal feeding, for any definite purpose, is less than it was thirty years ago by at least thirty per cent. In illustration of this fact, it may be said that in the preparation of animals for feeding purposes, as for instance in the case of a pig, they can be prepared and placed upon the market at a given weigh, with about two-thirds of the expense which would have been necessary to accomplish the same purpose thirty years ago. This economy in animal feeding is therefore one of enormous magnitude and value.

In the principles involved in the increasing of soil fertility, great progress has also been made in the time mentioned. So great has been the progress in this line that thousands of farms which had been abandoned by reason of sterility are now again brought under cultivation and restored almost to their virgin degree of fertility. The rapid exhaustion of the fertility in other soils has been checked by the application of the same principles. It is now certain that the production of immense crops can be continued indefinitely, under the scientific treatment, which the progress of agricultural chemical science has developed, without in any way impairing or exhausting the fertility of the soil. On the other hand, it has been seen that the fertility of a soil which has been partially destroyed is gradually restored under practically scientific treatment, while the fields themselves continue to give greatly increased yields. Thus it is seen that the fear which was formerly entertained by some philosophers of the final exhaustion of the fertility of the earth and the destruction of the human race, by the enforcement of hunger thereby, is entirely groundless.

The progress of agricultural chemistry has touched every department of agricultural science and the illustrations above given are only some of the more important ways in which the beneficent effects of the progress in this branch of investigation have been manifested.

DISEASES OF PLANTS.

Millions of dollars are lost every year in this country through such diseases as the rusts and smuts of cereals and the various blights of fruits, vegetables and other crops. As

a result of the investigations by the Department, many of the diseases are now successfully controlled and the way is opened for farmers and fruit growers to greatly increase the value of their crops at comparatively small expense.

The investigations carried on in connection with this work lead into many side paths: For example, one of the surest way of overcoming many of the difficulties met in the growth of plants in so extensive and diversified a country as this, is to develop strains and varieties adapted partiularly to the region in which they are grown. This may be done by breeding and selection. For example, through the crossing of a hardy, non-edible orange with an edible variety of the South. some forms have been obtained which it is believed will be resistant to the freezes which occasionally sweep over the southern section of our country. If these varieties prove to be all that we confidently expect, the growing of citrous fruits in the United States will receive a great impetus.

Of more direct interest to the people of the middle West and West is the work on the breeding of cereals, which is also carried on in connection with the work on diseases affecting such crops. Efforts are being made to increase the food value of corn by breeding and already some interesting results have been obtained. The nitrogen contents of this crop being variable, it affords good opportunity for developing varieties containing a high per cent of this important material.

There have recently been collected from Russia and other sections some varieties of wheat which it is believed will prove of great value to various parts of our country. These varieties are to be used pincipally as a basis for cossing with some of our well-known sorts, and it is confidently believed that the yield of many of the varieties now grown in the South can be materially increased and at the same time forms developed especially adapted to many other sections of the country. Great interest is being awakened in the possibilities of producing varieties for certain purposes, such as for the manufacture of macaroni, cracker-making, etc. It is to accomplish these ends that this work is tending, and at the same time every effort is being made to obtain varieties and forms which will be able to resist unfavorable conditions of climate and the many diseases which are intimately connected with the same.

No part of the country is neglected in this particular kind of work. Investigations are being made in the South for the purpose of improving the many varieties of cotton. Work is under way in the great timber belts for the purpose of obtaining accurate knowledge as to the causes of loss in our valuable timber lands through diseases. Investigations are

also being conducted in the cereal work in the Middle West and on the Pacific Coast extensive operations are under way which have aleady led to most valuable results, the means for preventing many of the serious injuries to the crops of that part of the country having been pointed out to the growers. Thus the work is constantly tending towards a better system of farming — a system which in time it is hoped will enable more of our people to make two blades of grass grow where only one grows now.

EXPERIMENT STATIONS.

It was just about twenty-five years ago when the first regular experiment station was organized in Connecticut. In 1887 there were 17 stations in 14 different States. In that year Congress passed what is known as the Hatch Act, which gave to each State and Territory $15,000 annually for the maintenance of an experiment station, as a part of the agricultural college. During the past ten years more than $10,000,000 have been spent in maintaining the stations. Of this sum $7,000,000 were contributed by the Federal Government and $3,000,000 by the States. For the same period the agricultural products of the United States were valued at $30,000,000,000. We have therefore spent just $1 for every $3000 worth of product in an effort to improve our agriculture and increase the output. These stations distribute about 5,000,000 copies of publications annually to nearly 500,000 farmers. Separate stations are supported in some of the States so that the total number in the United States, not counting branch stations, of which there are a number, is 54. Their total income for the year 1898 was a little over $1,200,000.

Among other work these stations, especially those east of the Mississippi River, have been engaged in the investigation and inspection of commercial fertilizers under State laws. In the State of New York over 900 brands of fertilizers were examined in 1898, and the station did not then complete its work. In Connecticut the business amounts to a million dollars a year, while in Pennsylvania it is estimated at four millions. The stations have done much to expose extravagant claims for fertilizers, showing that the advantage of farm manures, cottonseed, etc., and instructing farmers how to mix their own fertilizers. By testing varieties of grains, vegetables, fruits, etc., the stations have warned farmers against extravagant claims for new varieties. Nursery stock has been examined for fungus diseases and insect pests, and inspections made of seeds, adulterated foods, dairy products, butter increasers and preservatives, concentrated feed stuffs, quack medicines for stock and hog cholera remedies. The

stations have also exposed frauds in creamery construction and equipment and dairy apparatus. An important feature of their work has been the investigation of injurious insects and diseases of plants, such as the rot of grapes, apple scab, San Jose scale, gypsy moth, potato rot, potato scab, smuts in wheat and other grains. Through the discovery of an effective curd test the Wisconsin station has provided a means for detecting tainted or defective milk at cheese factories, a matter which caused a loss of from $100,000 to $200,000 each summer in Wisconsin alone. This station and the Minnesota station have been largely instrumental in introducing the growing of rape in those States and it is now grown on thousands of farms.

ENTOMOLOGY.

In applied entomology, or the work against injurious insects, the past thiirty years have been more productive of practical discoveries of great importance than the whole previous history of agriculture.

Aside from the intimate knowledge of the habits and life histories of our many insect pests which has been gained during this period, the principal factors in progress have been the discovery of the practical use of arsenical poisons for biting insects, the use of kerosene emulsion for destroying sucking insects, and hydrocyanic acid gas for the destruction of scale insects not only upon nursery stock but upon orchard trees, and the invention, marketing and practical use of a large number of mechanical devices for the distribution of insecticide mixtures, from the bucket pump and the knapsack pump to the steam or gasoline engine.

Instead of being at the mercy of a host of insect foes whose life round was unknown, as was the case 30 years ago, the farmer and fruit gower have now a fund of exact information, not only as to the habits and potential destuctiveness of nearly every one of these kinds of insects, but as to the best and cheapest mode of killing them or preventing their attacks.

This result has been brought about not only by the entomologists alone, but by the educated and practical farmers, quick to grasp a suggestion and put it to a practical test, and quick to improve upon a hint derived from a knowledge of the exact life periods and habits of their insect foes.

An important feature of work has been the introduction of the Australian ladybird beetle into California for the destruction of the white scale and of the same insect from this country into South Africa and Portugal where the same marvelous results were brought about. An entomological achievement, which, although it does not refer to the destruc-

tion of injurious insects, will still prove of lasting benefit to Ameican horticulture, was the successful introduction from Algeria of the fertilizing insect of the Mediteranean region into California and its establishment in that State, which assures the production of a commercial fig equal in quality if it does not surpass the standard fig of commerce.

FRUIT INDUSTRY.

The American fruit industry now easily surpasses that of every other country in the world. From only a garden industry it has broadened into a commercial undertaking of great magnitude.

Growers in different localites are devoting themselves more and more to the production of particular kinds of fruit which thrive best with them even though they be thousands of miles from the consumers whom they aim to supply. The most notable instances of this are the pineapple and orange districts of Florida and the orange and lemon districts of California, the strawberry fields which extend from Florida all along the Atlantic Slope and supply fruit from January until the middle of July. Successful and profitable shipments of peaches are made from Georgia to points many miles away.

An important factor in this commercial fruit-growing has been the application of artificial or mechanical refrigeration to the preservation of fruits beyond their normal period. There has been marked increase both in the number of varieties planted and the area devoted to fruit culture.

INTRODUCTION OF NEW CROPS.

One line of investigation which has proved particularly productive of valuable results has been the introduction into the United States of new crops or new varieties of well-known crops, which have added greatly to the productive capacity of our present agricultural areas in localities where our common agricultural crops cannot be grown. In 1888 the Department of Agriculture established in the arid region of Western Kansas a station for testing crops suited to the conditions of that belt. One of the plants thus demonstrated to be a success was Kaffir corn, which was grown last year in the State of Kansas alone to the value of over five million dollars. The Department has imported from Turkestan a variety of alfalfa which promises within the next decade to add millions of dollars annually to the forage-producing capacity of the arid region.

FORESTRY.

At no time in our history has the interest in forestry been so genuine or wide-spead as at present. The Goverment has

withdrawn for sale nearly 47,000,000 acres of public land to be held as forest reservations.

GRASSES.

In 1815 the hay product of this country is reported to have been 12,839,141 tons, New York State alone producing one-fourth of that amount. The hay product in 1898 reached the enormous amount of 66,000,000 tons. Today the livestock of the country dependent upon grasses and forage plants for their food supply is in round numbers 138,000,000 valued at nearly $2,000,000,000. This increase in livestock has arisen not only through the opening of new grazing lands, but through improved systems of agriculture which have materially increased the forage product of the soil.

THE DAIRY INDUSTRY.

Progress in dairying has been equal to that in any other branch of agriculture. In 1865 there were five hundred (500) cheese factories in operation in the State of New York and 1000 ten years later. In Ohio one cheese factory was started in 1861; in 1874 there were 100, and nearly 500 in 1880. There are now about 3000 in the whole country and practically all the cheese of the United States is made in factories. The same general plan was adopted for butter-making and all now know how common creameries are now and how useful in the counties where located. Creameries were first established in New York in 1861; in Ohio in 1865; in Illinois in 1867 and in Iowa in 1871. There are now seven or eight thousand creameries in the United States and the system is extending rapidly. Not half of the butter of the country is yet made in creameries, but farm dairy butter is mainly consumed locally so that the creamery grades practically control the large markets. The yearly dairy producton of the Union is now estimated as follows:

1,430,000,000 lbs. of butter, valued at	$257,400,000
300,000,000 lbs. of cheese valued at	27,000,000
2,090,000,000 gals. of milk, valued at	167,200,000
a grand total of	451,600,000

If the proper feeding value of skim milk, butter-milk and whey are added, and the value of the calves dropped yearly the annual aggregate value the product of our dairy cows in America, is over $500,000,000. This is a very conservative estimate and thought by some to be too much so.

Next to the adoption of the factory associated system, which is of American origin, the one thing which during recent years has given the greatest impetus to the dairy industry in this country is the introduction of the mechanical method of skimming or separating cream from milk. The

centrifugal cream separator made its first appearance in America in 1879. We are indebted to Europe for this invention, at least as a dairy appliance. It is the only instance in which dairy invention abroad has been notably in advance of the United States. Yet investigations were in progress contemporaneously in this country along the same line, and many of the material improvements in the cream separator have since originated here. The machine has been vastly improved during its twenty years of existence. Besides its economy and its effect upon the dairy labor, the separator almost eliminates the factor of climate in a large part of dairy management, and, altogether, has worked a revolution in the industry. Although quite an expensive piece of machinery, its adoption has been so general, especially among creameries, that there are now more than forty thousand cream separators in use in the United States.

Another great dairy invention of the period is the popular fat-test for milk, being a quick and convenient substitute for chemical analysis. The test-method most generally approved in America and now also in foreign lands is that which has become so well known under the name of its inventor, Dr. S. M. Babcock, of Wisconsin. This fat-test of milk has such wide application that it may fairly be questioned whether it is second to the cream separator in advancing the economies of dairying. The percentage of fat being accepted as the measure of value for milk for nearly all purposes, the Babcock test may be the basis for municipal milk inspection for fixing the price of milk delivered to city dealers, to cheese factories, creameries and condenseries, and for commercial settlements between patrons in co-operative dairying of any kind. By this test also the dairy farmer may prove the quality of milk from his different cows and (with quantity of milk-yield recorded), may fix their respective value as dairy animals. Cows are now frequently bought and sold upon the basis of the milk-scale and the Babcock test. With perfect apparatus, in competent hands, the accuracy of the test is beyond question and it is of the highest scientific value and practical use. It should be noted that although clearly patentable, and offering an independent income through a very small royalty, this priceless invention was freely given to the public by Dr. Babcock.

The advent of the twentieth century finds the dairy industry of the United States established upon a plane far above the crude and variable domestic art of three or four generations ago. The milch cow itself, upon which the whole business rests, is almost as much a machine as a natural product and a very different creature from the average

animal of the olden time. Instead of a few homely and inconvenient implements for use in the laborious duties of the dairy, perfected appliances, skillfully devised to accomplish their object and lighten labor, are provided all along the way. Long rows of shining tin pans no longer adorn rural dooryards. The factory system of co-operative or concentrated manufacture has so far taken the place of home dairying, that in entire States the cheese vat or press is as rare as the hand loom, and in many counties it is as hard to find a churn as a spinning wheel.

WEATHER BUREAU.

Of great service to agriculture has been the work of the United States Weather Bureau. Its first and most important work is to give to the farmer trustworthy information of coming weather changes with such promptness that it may be utilized in planning operations for the period to which the prediction applies. To do this successfully and economically has been one of the most difficult problems with which the Bureau has had to contend. In the earlier years of the Bureau's existence it had, as now, accurate foreknowledge of coming weather changes, but the means for rapid dissemination of that information, of such immense value to the public, were unsatisfactory and very inadequate. In recent years through the rapid extension of telephone systems, increased telegraph facilities and vastly improved postal service, the Bureau has been enabled to place its weather forecasts before the public so promptly that all cities and important towns, and a vast number of the smaller towns and villages are now given prompt weather service. So greatly has the system of distribution been extended throughout the country that at this time there are issued and distributed approximately 100,000 weather bulletins daily, a large majority of which go into the smaller towns and villages for the benefit of the agricultural classes.

Besides this daily distribution the Bureau is enabled by its River and Flood service, in times of heavy rains when dangerous stages of water are likely to occur, to inform the sections endangered; and by its timely warnings of threatened overflows, it not infrequently in a single instance saves to the public more than the total annual cost of its maintenance for a period of years.

A scarcely less important work than that of issuing forecasts is the Climate and Crop service in which more than three thousand voluntary observers take daily observations of temperature and record measurements of rainfall, using instruments of the Government standard. The observations are col-

lected at the State centers and utilized in the preparation of monthly weather reviews that are published promptly after the close of each month. By these publications the climatic features of the several States are established and made known to the general public, the information being of value in affording data for studying the meteorological conditions under which crops are grown. The current value of these publications is not only material, but their prospective usefulness will increase as the length of the records are extended. There are two prominent features of the Climate and Crop service of the Bureau: The first has just been mentioned; the second is the collection and publication of information as to the effects of current weather conditions upon crops during the growing season. This information is carefully summarized by the expert at the central station in each State, where a weekly bulletin is prepared and given a wide distribution through the press and otherwise, so that the farmers may keep fully informed as to the progress of crops and farm work in all counties. A summary is telegraphed to Washington from each central station to be utilized in the preparation of the National Climate and Crop Bulletin issued weekly in that city. This Climate and Crop Service of the Weather Bureau should not be confused with the work of another very important part of the Department, viz., that of the Division of Statistics, the duties of which are wholly distinct.

INTERNATIONAL DEVELOPMENT.

After having considered the development of American agriculture it will be well to consider it as an international factor. At a time when cities and towns were small and industrial centers few, each city could be provided with its necessary food by the surrounding farms, but with the tendency to build great cities like London, Berlin, Paris and New York, it is a natural result that food stuffs must be transported by rapid transit for long distances in order to supply the great centers of population.

England has so changed from the agricultural to the industrial, that London can no longer depend upon Great Britain for the food necessary for her large population, and hence she turns to the American and Australian farmers for aid. Cattle raised in Texas and the West are killed and dressed in the large abbatoirs of Chicago, Omaha, St. Louis and other American cities; they are rushed to the ocean "greyhounds" in New York harbor by specially constructed refrigerator cars and are speeded across to London in refrigerator space in less than eight days. The American farmer thus not only contributes to the greatness of his own country, but

also the greatness of large foreign cities like London. Germany, too, is rapidly changing from an agricultural to an industrial state and is looking to this country for the food necessary for her own existence and development.

Seeing that competition is constantly growing more keen and may be expected to increase in the twentieth century, our Government has within the last few years sent experts abroad to study agricultural conditions in foreign lands, to protect our exports, to find new markets, to procure new seeds and to act as scientific assistants in the diplomatic corps.

AGRICULTURAL ASSOCIATIONS.

Agriculture has been greatly stimulated in every way during the past twenty or thirty years by the earnest work of Granges, Farmers' Institutes and agricultural associations, such as the present assembly, and I believe that we should endeavor in every way to increase the organization of such associations.

The agricultural interests can not be entirely separated from the other great interests of our country ; there is a mutual dependence. When Labor and Capital are fully employed and prosperous, Agriculture will be more progressive than when opposite conditions prevail.

We must not, however, lose sight of the fact that we must give especial attention to our own interests. Some of the methods and demands of both Labor and Capital are inimical to the interests of Agriculture, and the farmers must make their power available for self-preservation. We must recognize the fact that neither organized Labor nor Capital can be depended upon to guard our interests. The time for intelligent, united action on the part of farmers is upon us. If we are neglectful or cowardly, if we hesitate to act promptly in our own interests, we shall not escape the penalty. We must deal with all questions, all parties and all men in a way that will show to all that intelligent farmers know their rights and have the courage and ability to maintain them. There are many existing inequalities and abuses that need our immediate attention, but I shall not take time to enumerate them. Every intelligent man knows of their existence and also knows that the farmers have the power to correct them if it is only made available. I am one of those who have always believed that the Agricultural Giant would some day realize his power and make such use of it that all would learn to respect his rights and join with him in efforts to secure to all a fair reward for honest toil. I am not discouraged, but I am just a little impatient. If we would continue

to prosper and enjoy the fruits of our own industry we must guard well every interest of agriculture. We can not do this without a thorough organization of our forces. There is no excuse for delay.

GROWING POTATOES IN VERMONT—CLOVER THE FOUNDATION.

Delivered at Burlington, Aug. 25, 1899, by T. B. TERRY, of Ohio.

To get the best results for a term of years potatoes should not be grown oftener than once in four years on the same land. Blight, rot, scab, etc., are more likely to make trouble where this crop is grown continuously, or even two years in succession. Where potatoes are to be made one of the main crops, the following rotation will give the best of results : Clover, corn, potatoes, small grain and clover sown with it. In other words, divide the plow land into four equal parts and have one part in each crop every year. Mow the clover but one year. I know this is quite contrary to the general practice in Vermont, but where the land can be plowed readily it is the wisest way. Of course, steep side hills and very stony land must be managed differently. Put the stable manure on the clover sod for the corn ; then it will be in just the right condition for potatoes the following year. It is not well to use fresh manure for potatoes ; they like old, decayed fertility better. You will notice that I have put in clover as the foundation crop in the rotation. Do not leave it out. Do not substitute timothy. Timothy feeds on the soil and leaves it poorer. Clover gathers its nitrogen and mineral matter largely from the air and subsoil and actually makes the soil richer. Timothy hay is not nearly as good for cows giving milk, for young growing animals, for sheep, etc., etc., as is early cut and well cured clover hay. And by cutting clover twice in a season one can get much more hay to the acre than he can from timothy. It is useless to say that clover can not be made to grow in Vermont any more, for the writer saw on the farm of Mr. C. F. Smith, last August, as dry as was the season, the second crop of red clover that would make about two tons of hay per acre. If Mr. Smith can make it grow, you can by following his plan, and it will pay you grandly. Clover sod is good for potatoes ; they may be planted directly on it with the best of results; but most farmers want to grow corn and so I would put the corn on the freshly manured sod and let the potatoes follow. At first it may be well to use a little fertilizer for the potatoes and small grain, particularly acid phosphate and potash, but in due time one can certainly get along with very little and perhaps without any, if all manure, liquid and solid, is carefully saved. I particularly urge

you to make heavy crops of clover grow on your land as a foundation for potatoes and other crops, because you will thus get fertility for nothing that perhaps now you are buying in bags. You will be able to produce your crop cheaper and thus can compete with the farmers in Michigan, Wisconsin, Minnesota and other states, who are growing potatoes by the hundred acres on land that is rich and easily cultivated. To depend on purchased fertility largely means slow starvation for you on the average. You must learn a better way. The writer speaks from thirty years' experience in bringing up a rundown farm by growing clover until it would produce large crops without any purchased fertilizer. Cultivate, cultivate, cultivate.

Your fields are usually small. The western farmer sometimes has one hundred or two hundred acres of unbroken potatoes. He does things on a large scale. He rarely takes the best care of a crop. Possibly he may do as well getting a smaller yield on many acres as he is situated ; but we won't talk about that. You can't do it; you must not try. Your only chance lies in thorough work. You must work the soil over and over and over again before planting; you must work it many times while the crop is growing. You think perhaps your soils are about worn out, but they are not. There are probably fifteen tons, or more, of plant food—nitrogen, phosphoric acid and potash—in an average acre of Vermont plow land, within one foot of the surface. Your plants do not get this food because it is locked up, or unavailable. Nature makes very little available each year. Old-fashioned methods of tillage do not help her much. To plow the ground and harrow it over and plant potatoes and cultivate them three or four times is not enough. Work the ground over and over, deeply and thoroughly. Make it very fine when quite dry. Begin to harrow with a smoothing harrow as soon as the crop is planted. Go over them three or four times before they come up. Then use a weeder and cultivator, and later a cultivator alone, twelve or fifteen times or more. Then you are unlocking some of that plant food for the crop. If the tillage is properly done, it will cost you much less than purchased fertilizer. You will not only be helping the potato crop, or corn crop, that you put this tillage on, but the small grain crop following and the clover will be better. However, the best results in liberating plant food will not come on land that is deficient in humus, or decaying vegetable matter in the soil. Grow clover to get vegetable matter to plow under, roots and stubble. Feed out the clover and corn and straw and purchased grain, and save all manure and return to the

land; then work it and work it and you can increase your crops.

You want to learn to do this work fast or you may get left behind. A western farmer thinks nothing of driving four or five horses that are drawing a wide disk harrow, and leading three more that are drawing a smoothing harrow behind. You must learn as far as practicable to make your fields larger and drive more horses, and get more work done per man, if you want to keep up. Let the first cultivation of potatoes and corn be deep, very deep; in fact, you may well go over them the second time within four or five days, very deep ; then let all the work be shallow, not more than two inches deep. The roots come together between the rows before the potatoes are six inches high, on good ground. They do not grow down, but out horizontally. If you cut them off, the plant must grow them over again. If it is dry weather this means decided loss. Again, it makes a difference when you cultivate. You may go over a field once in five days and not get the best results unless you select just the right days. The ground should never be left to dry up and crust over after a rain, from the time it is placed in the spring until the tops of potatoes cover the land. Harrow or use a weeder after every rain, as soon as the land is dry enough to go on to. Later, cultivate in the same way. If it is a dry time cultivate again within a week any way, not waiting for a rain. Keep the surface stirred and loose, as it makes a mulch that checks the evaporation of water. The soil and subsoil are full of water in the spring; with care along this line you can save hundreds of tons of water from going up into the air—save it for your crop. And always remember that in a dry time the finer you can make the surface you stir with the cultivator, the better mulch it makes. We attach a board at the rear of the cultivator in such a time, to drag on the ground and rub the surface fine. With the shallow work spoken of above, you need not stop working potatoes at blossoming time, but may continue as long as a horse can get through. Narrow the cultivator as the season advances and you will do only good and no harm. You will keep weeds down, check evaporation and liberate plant food up to the last minute. In a very dry season, when the tops did not get too large, I have cultivated until the crop died.

Now, good friends, I am not giving you some idle theory, but the result of many years of experience. We have made thousands and thousands of dollars by carrying out just what I have told you above. We have grown potatoes at small cost and realized very large profits. Of course I cannot go all over the subject in an article of this kind ; it takes a book to

do that ; but I have given you, free gratis, the great foundation of our success — "clover and tillage." Very briefly I might add, don't let your seed sprout at all until after it is in the ground, for main crop. Don't use any potatoes for planting except ripe, sound, perfect ones of good merchantable size. Treat all seed for scale; spray if you are troubled with blight. By the way, I saw a western wheel cultivator with a sprayer attached that the driver used to spray a row at the same time he was cultivating it. You will have to stir yourselves to compete with these fellows, but a Yankee should be able to get ahead of them. Find what will do best on your soil and then do not grow more than one or two kinds. Straight goods sell better than mixed. Don't let any light get to your potatoes for a minute that you can help, from the time they are dug until they are eaten. Don't let light get to them in the soil ; it makes them yellow inside, if not green. For this reason, and to avoid injuring roots, we have always gown them in drills and without hilling. With the weeder and harrow they can be kept clean just as cheaply. If you grow potatoes on a large scale get a Robins planter and a Hoover digger. If the land is not over steep, side hill, or too stony, and the potatoes are ripe and sound when dug, the Hoover will do nice work; but we use four horses on it. It is all iron and not suitable for digging green potatoes, of course. We find bushel boxes very nice to pick up in, using them by the hundred. They are made of light wood and are 16 x 13 x 13 inches inside, with finger holes in the ends. You can buy them, in the flat cheaply, of the A. I. Root Co., Medina, O. In a small way, plow out furrows four inches deep for planting, and plow back. We cut seed mostly to one eye, but it is prime, sound seed, and the soil is rich and culture high. Use more seed for less favorable conditions. Drill culture and light seeding gives us a crop more uniform in size.

VERMONT'S INTEREST IN FORESTRY.

Delivered at Vernon, Jan. 15, by ERNEST HITCHCOCK, of Pittsford.

The past twenty years have seen a very rapid increase in the public interest in the subject of forestry in this country. Popular misapprehension as to the objects and methods of forestry have been to some extent dissipated. Appreciation of the importance, if not the absolute necessity, of the application of its principles to the treatment of our forest and waste lands has become widespread. Gradually the truth is becoming known that forestry is a practical thing in its application to the conditions existing in this country. Prejudices arising from the mistaken idea that the advocates of forestry in America contemplated the adoption without change of the expensive and complicated European system are disappearing. It cannot be too often or too emphatically stated that forestry does not aim at the creation of a vast park system. Forestry is not landscape gardening. Its aim is the direct promotion of the material, pecuniary interests of the people.

The continued existence of our forest area in proper proportions is necessary.

1st. As a source of wood and timber.
2d. To protect water supply.
 (a) To maintain rivers and steams.
 (b) To supply moisture to crops and pastures.
3d. Because of its effect on climate.

Anything like a complete outline of the subject of forestry, to say nothing of a discussion, is of course utterly out of the question within the limits here available. I purpose only a few suggestions as to how we Vermonters are specially interested in this subject. Our interests are not small. We have nearly six million acres of land in Vermont, of which forty-five per cent. is said to be improved, forty-two per cent. forest and thirteen per cent. waste. My judgment is that our actual waste land enormously exceeds this proportion. We have in this state nearly as manysawmills as the state of Maine the great lumber state of the east, and their capacity is about five-eighths as great. Our lumber interests exceed those of each of the other New England states except Maine. It is obvious therefore, that this interest is sufficiently great to deserve attention.

It is, perhaps, a question whether we suffer sufficiently from forest fires to make legislation desirable on this subject.

In some sections of our country the great question of forestry is protection against fires. The damage done by these forest fires is almost incalculable. In single years, areas have been burned over in the United States double in size the whole state of Vermont. It is obvious, of course, that in comparison with Michigan, Wisconsin, Minnesota and other portions of the country Vermont's sufferings from forest fires are small. Nevertheless much damage is done even in our small and broken state. Whether any means can be devised to prevent this injury without creating too complicated government machinery is a question I will not attempt to answer. In any case, the public should be educated on the subject. Individuals should appreciate the importance of keeping fires properly set under control and that none be lighted when there is danger of their escaping from control.

We often hear it stated that our forest area in Vermont is increasing, that we are not using our timber as fast as it grows. The two statements are by no means equivalent. The former statement is quite probably true. The latter I seriously question. Even were both true it by no means follows that, as sometimes seems to be implied, we can safely leave the forestry problem in this state to take care of itself. The truth probably is that our forest area is not rapidly changing in amount but that the character of the forest cover, its economic value, is rapidly deteriorating. Instead of being covered with valuable timber, much of it is mere "scrub" of a character which never will be valuable as timber. Nevertheless this scrub has its value and an important one. I think it may be safely stated that Vermont has not the absolutely vital interest in forestry which some localities have. I do not believe Vermont is in any danger of becoming a barren waste, barren and depopulated, as have some localities from the destruction of their forest cover. The head waters of our streams, the slopes of our mountains are still largely protected by some sort of forest cover. The trouble is, however, that our children and children's children will look in vain to these sources for the supply of pine and spruce our fathers found. Nor is this of slight importance. Our purchases of lumber from outside will not only be greater, but it seems more than probable that the price will be enormously increased. It is difficult to see how this country is to escape a timber famine. A few facts only can be cited. Of pine, our most important timber tree, the original supply is estimated at seven hundred billion feet. We have now left of this only one hundred ten billion feet. Of all the coniferous timber trees in the United States, we have now left but about thirty years' supply. The east has only about a fifteen years'

supply. The pine of the east has been practically exhausted. Within the past few years the lumber industry of Maine has changed from pine to spruce. The United States uses annually the annual growth of one billion acres of well cared for forest land. Our actual resources are less than one-half that number of acres, ill cared for. In view of these facts, would it not be the part of wisdom for Vermonters to handle their timber supply economically, with a thought for tomorrow as well as for today? At present, thousands of acres of young spruce and pine are being cut just at the time when they are increasing in quality and quantity most rapidly. Other timber, which is ready for cutting, is being so handled that the land is left practically a waste, instead of being left in conditions to reproduce another crop of valuable timber. To what extent, if any, the state should undertake to regulate the manner in which private owners handle their timber tracts is too complicated a question to discuss here. The federal government is attempting something in this direction, not of course by force, but in the way of furnishing advice and working plans to owners of timber tracts who wish to handle their property in an economical manner. If this state, for instance, could prevent the cutting, for commerical purposes (unless desirable for thinning or clearing land), of all pine and spruce less than ten inches in diameter, it would confer an enormous benefit on the next generation. It would not only preserve the individual trees, but also would insure the preservation of enough seed trees to reseed the areas cut over to valuable kinds of timber.

There are many individual farmers in Vermont also who, I think, can afford to take a practical interest in various phases of this subject of forestry. It is probably of little use to urge farmers to plant forests as a crop to any great extent, although there is no doubt that in the end it would prove the most profitable crop that can be raised on many tracts of land. When so few care to plant orchards and wait a dozen years for their reward, still less will plant pines and wait fifty or a hundred years.

The following points are, I think, worthy of consideration by many farmers of the state who own no extensive timber tracts and who are not interested as lumbermen.

1. The economical handling of the farm wood lot. Two things are to be chiefly considered; one is to cut first such timber as has reached its prime, leaving by preference such as is still growing vigorously; the other is to cut in such a way that the tract cleared each year will be readily reseeded by trees of desirable sorts left standing.

2. The planting of waste places on the farm.

(a) As a crop.
(b) To improve pastures.
(c) To improve tillable lands.
(d) As windbreaks.
(e) To prevent frost.
(f) To prevent erosion and gullying.
(g) To conserve moisture.

A few further words may be admissible in explanation of some of these points. As already stated, I do not look to see much done by individuals at present in the way of the planting of forests simply as a crop. Whether it is not time for our state to take its place with other progressive states in the acquirement of waste lands and in their reforestation is another question.

One of the most discouraging features of our Vermont agriculture is the condition of our pastures. Portions of a great many of them are practically worthless. The steep hillsides have been beaten upon by wind and storm and washed by the rains until no valuable grass grows on them. The rain that falls on them washes off at once; the sluble fertility is gone. They are too steep, rocky and inaccessible to render tillage and fertilizing profitable. I know of no way in which they can be profitably reclaimed. Now if the hilltops and upper slopes could be covered with forest, I believe two ends would be served. Valuable timber could be produced and the soil renovated. The lower portions would also be improved, through the conservation of moisture by the forest cover. Erosion and gullying would be stopped; the melting of the snow in the spring would be delayed and more of its moisture rendered available. Every rain that came would, instead of rapidly running off on the surface, be retained by the soil cover under the trees, soak into the ground and gradually percolate beneath the surface and be available to supply needed moisture to vegetation lower down.

In many places, on many farms, a windbreak would have an extremely beneficial effect. It has been found a valuable protection to many orchards. It would also operate to prevent the loss of much moisture. Nothing dries up land more than the passage of the air currents over it. It has been said that a windbreak protects a rod of land for each foot of its height. So it will be seen that if properly located its influence is quite extensive.

Little can be said here as to the kinds of trees to plant or the methods of planting. The white pine is easily the monarch of our trees. It is in forestry what the corn plant is in our agriculture. It is hardy, does well on most soils and its rate of growth is good, though of course it varies greatly.

Trees forty years of age run from six to eighteen inches in diameter. An acre of pine frequently grows 50,000 feet of lumber, board measure, in fifty years. one-half that more often, however. Even the smaller rate of growth, and at present prices. would return good interest on the investment, and prices are practically certain to advance.

Spruce is a good second of our coniferous trees and the progress of the paper pulp industry threatens to soon render it as rare as pine. The ready market we are now finding in many localities for poplar and white birch, trees we have been accustomed to regard as inferior, suggests that they might constitute a valuable part of some plantation. Their rapid growth is a strong point in their favor.

On some barren knolls the main question may be at first of what sort can a stand be obtained. Our common locust, in spite of the contempt in which it is often held, may be useful in such places. It has a high value as posts.

In general every plantation should consist of several kinds of trees, which should be chosen with reference to their adaptability to the location, the object in view, and to each other. The best advice I can give is to study the matter carefully before starting a plantation. Assistance can be obtained gratis from the Division of Forestry, Department of Agriculture, at Washington.

Since 1886 the annual reports of the Secretary of Agriculture, known since 1894 as Year Books, have contained a large amount of valuable material on this subject.

The following are perhaps worth special reference: Tree Planting in Waste Places on the Farm ; Year Book, 1896, p. 323. Relation of Forests to the Farm ; Year Book, 1895, p. 333. Forestry for Farmers ; Year Book, 1894, p. 461. Various other bulletins, circulars, etc., on this subject have been issued by the department from time to time, some of great value, but there is so much uncertainty about the readers being able to secure them that it is hardly worth while to refer to them.

COMMERCIAL APPLE GROWING IN VERMONT.

By T. L. Kinney and F. A. Waugh.

Most persons in Vermont look upon apple growing as one of the smallest incidents of farming. They think it is all very well to have some apples for the family to eat, providing it does not require too much work to grow the fruit. But as for planting an orchard and attending to it as to any other business, with a view to making a profit from it, they know nothing about it.

Nevertheless commercial apple culture in this state is not an idle dream. It is a practical fact. There are a number of bearing orchards, ranging in size from five to twenty acres or more, which yield their owners a handsome profit. Merely as one example we may mention the orchard of the late H. D. Allen at South Hero. In 1899 this orchard, of about 14 acres, produced a fair crop of apples, due to good culture, and in spite of the "off year." Mrs. Allen sold the seconds and some of the other apples at the house, to the amount of about $700. She then shipped the best apples to New York in March, 1900, where they all sold at an average of $5.22 a barrel. Some of the best — extra select Spies — brought $8, $9 and $10 a barrel. The entire carload sold for $848.25, which after deducting freight, cartage and commission, left $713.40 net. Adding this to the $700 received for apples sold at home and we have a net income of $1,400 in an off year for fourteen acres of land!

If there is any other line of farming in the state of Vermont which pays equal profits, we have failed to hear of it.

In 1896, the year of over-production, when the apple markets were glutted, this same orchard yielded a handsome profit, though not then in full bearing. That year Mr. Allen shipped 562 barrels to New York, which sold for $1,273.52, bringing a net return of $971.45. We do not have a record of the apples sold at home for that year, but there were certainly enough to bring the net returns safely above the $1,000 mark.

Knowing this orchard intimately as we do, and basing our opinion on what it has already done, we think it a very conservative estimate to say that it will, with proper care, return an average net profit of over $50 an acre each year for many years to come.

Several other orchards in the state could show records almost equally good.

With these facts in view we feel that many more farm owners in Vermont ought to become interested in the cultivation of this noblest of all fruits — the apple.

LOCATION AND SOIL.

Grand Isle county is undoubtedly the most famous locality in Vermont for the production of apples. Other parts of the Champlain valley, especially in Addison and Chittenden counties, are known to grow good apples; but aside from these the commercial orchards are few and far-scattered. There is an opinion prevalent, both in Grand Isle county and in other parts of the state, that the surrounding waters of Lake Champlain give this county a great advantage over other localities in the production of fruit. In our opinion this advantage has been greatly exaggerated, if it be not, indeed, wholly imaginary.

On the other hand, much of the farming land of Grand Isle county possesses a rich, porous, gravelly, deep, well-drained soil, most admirably adapted to the growth of the apple tree. All the successful orchards of the islands are on such soils. There are other spots in the county, as for example the southeast corner of Isle LaMotte, where apples entirely refuse to grow, in spite of the proximity to the lake. Outside Grand Isle county one still finds the best orchards on the same kind of soil. The famous orchard of Dr. T. H. Hoskins in Derby has the same kind of soil, and was, a short time ago, one of the thriftiest and best plantations in Vermont. It could not owe its prosperity to any body of water ; but it was built on the right kind of soil.

For these reasons we are led to recommend deep, well-drained, rather gravelly soils for apples, in this state. And we would say to anyone who has such soil, "Go ahead and plant it to apple trees, no matter what part of the state you live in. You stand as good a chance of success as anybody."

VARIETIES.

In starting into the apple business the first question is naturally the selection of varieties. There are a great many different sorts to be had of the nurserymen, but only a few of them are successful when grown for the market in this state. A canvass of Grand Isle county, made in 1896, showed the following to be favorites at that time : Northern Spy, Rhode Island Greening, Baldwin, Fameuse, Tolman Sweet, Pound Sweet, Golden Russet, Ben Davis, Bellflower and Arctic. The sweet apples have been so badly attacked by the apple maggot of late that they would probably now be ommitted from the list. This list might be improved, perhaps ; but it is fairly representative of the varieties now grown in the islands.

In Bulletin 74 of the Vermont Experiment Station, issued in December, 1899, the following varieties of winter apples are recommended for the home garden : King, Spitzenburgh, Spy, Rhode Island Greening, Baldwin, Arctic, Golden Russet, Hubbardston, Seek-no-further, Belleflower, Tolman. Several of these are also good commercial varieties. To them should be added McIntosh and Fameuse, both late fall apples, but often among the most profitable market varieties. *In general only late keeping winter varieties should be planted for market.*

For the colder parts of the state more hardy varieties are required. The best experience now available shows that confidence may be placed in the following : Longfield, Fameuse, McIntosh, Wealthy, Scott Winter, Pewaukee, Wagener and Arctic.*

HOW TO GET TREES.

The farmer ordinarily buys his trees of the fruit tree agent. He pays an exorbitant price, often gets second or third class stock, and many times it is not true to name. Usually the best way is to order trees direct from a responsible nurseryman. In the last few years there have been quantities of first class apple trees sold to planters in Vermont at $25, $20, $18, $15 and even as low as $14 a hundred. About $15 to $20 may be looked on as a fair price for trees of standard varieties, though all nursery stock has advanced strongly within the last year. If one does not know a reliable nursery to buy of he should ask advice of someone who does know. We know of several.

PLANTING.

Trees may be planted either in spring or in fall. In general we prefer spring planting.

Most apple orchards have the trees set too close together. Two rods each way is as close as any varieties should ever be set, and 40 feet is better, especially for large growing sorts. Trees are sometimes set close with the idea of cutting out alternate trees later ; but we have never known this to be done successfully. Usually the thinning out is neglected.

CULTIVATING.

It used to be a question for argument as to whether it was best to keep an orchard cultivated or seed it down to grass. This question is no longer open. It has positively been decided that a man who expects to make money out of

*See also Vt. Experiment Station Bul. 74, p. 93; and Bul. 61.

his orchard in this country must give it good cultivation every year.

The method generally found most successful may be briefly outlined as follows: Plow the ground in the spring just as soon as it is dry enough to work. Make this plowing as thorough as circumstances will permit. Even if some good-sized roots are cut or torn at first no special damage will be done; and if an orchard is kept well worked roots will not for m near the surface. After the first cultivation with the plow the ground should be frequently worked with a sharp harrow or similar tool. These cultivations should follow one another about once in ten days or two weeks, depending somewhat on the weather. The drier the weather the oftener the ground should be worked. This sort of surface cultivation should continue till the first to the middle of July, when the ground should be sown to some sort of cover crop. A "cover crop" is any sort of catch crop intended to cover the ground during winter and to be turned under the following spring. The best crops are clover, rye, peas or peas with buckwheat.

FERTILIZING.

An orchard ought to have some fertilizer, just the same as any other crop. Barnyard manure ought to be given once in a while — more often on sandy lands and those which have not enough life in them. On ordinary lands a good dressing of barnyard manure, say fifty loads to the acre, every fourth year, will be fair treatment.

Muck, which is found in quantity and sometimes in excellent quality, in various parts of the state, may be advantageously applied to apple trees. The amount will depend on the land and the quality of the muck.

Amongst commercial fertilizers we would espceially recommend muriate of potash, ground bone and acid phosphate. If desired these may be bought in mixture; but it is better to buy them separately and mix them at home. They may be mixed in equal quantities, and should be applied annually. We think that about a half ton of this mixture to the acre annually would be about right for a bearing orchard, though this opinion is not founded upon such exact observation as we might wish.

PRUNING.

Pruning should commence when the tree is first set in the orchard, and continued from year to year as long as the tree lives. First cut away the bruised or broken roots with a sharp knife and shorten the very long ones. After the trees have

been set in the ground a few days, long enough for the ground to become fixed about the roots so the tree will be firm in the ground, the top of the tree can be very easily trimmed. Trim high as you want the lower branches when the tree is grown. If the tree is too short for this, trim all the branches off and form the head the next year. Trim every April, cutting away suckers and also limbs liable to cross others and chafe them. Later keep thinned out enough to let the sunlight in among the branches.

SPRAYING.

Spraying is necessary in an orchard which is run for profit. In certain cases, of course, fair crops of fruit may be grown without spraying ; but as a rule this cannot be done. At all events when a man can spray a tree at a cost of two to three cents and secure an increase in the crop of $2 to $3 worth, — as he usually can — he ought to spray. That is, ought to spray if he is growing apples for money. If he is running his orchard just for the fun of it he may do as he pleases.

The principal insects which trouble apples in this state are the codlin moth, the tent caterpillar and the apple maggot, or railroad worm. The last named can not be controlled by spraying. In fact, there is no thoroughly satisfactory remedy known. The principal fungus diseases in the apple orchard here are canker of the tree and scab of the fruit. Both these diseases, and all the insects except the apple maggot can be kept in check or exterminated by spraying.

For the fungus diseases spray with bordeaux mixture, made as follows : Take 6 pounds copper sulphate (blue vitriol), 4 pounds of stone lime and a barrel of water. Dissolve the sulphate and slake the lime in separate vessels, dilute each with about half of the total water to be used and then pour the sulphate solution into the lime water while stirring vigorously. Continue the stirring for a minute or so to insure perfect mixture. The mixture deteriorates somewhat upon standing and should therefore be used soon after made. Use precautions to keep the mixture clean to avoid clogging of pump and nozzles; strain the solutions and have a strainer on suction tube of pump. A quick and convenient way to dissolve copper sulphate is to place it in a cheese-cloth or similar bag and suspend this just below the surface of the water.

For spraying against the insects add a quarter of a pound of paris green to each barrel of bordeaux mixture. If one sprays for caterpillars or codlin moths only, without reference to fungus diseases, the paris green may be used in the same proportions in clear water — a quarter of a pound to the barrel.

The apple orchard ought to be sprayed once before the leaves start in the spring. In this case the bordeaux mixture should be used withont the paris green, or a pure blue vitriol solution may be used without the lime. A second spraying should be given just before the blossoms open, and a third soon after the blossoms fall. A fourth spraying may be given about two weeks later if the weather indicates ; and even a fifth spraying has been found to give large cash profits in some cases.

For spraying, a good pump, a barrel, a piece of hose and a good nozzle are necessary. These can be bought of the manufacturers for about $7 or upwards, depending on the size and make-up of the apparatus. If one is unused to spraying he had better get advice from someone who has had experience. In general a man may put every confidence in the directions given by the manufacturers of apparatus. who naturally will take considerable pains to instruct their customers in the proper use of the machinery, proper times for spraying etc.

PICKING.

The best time to pick apples depends on the varieties, on the season and on the market to which they are going. Late winter sorts, like Spy, when destined for the city market, should be allowed to hang on the trees as long as possible. This will be several weeks after the first frosts, and after the leaves have fallen. Varieties which ripen earlier, or which are to be sold earlier may be picked sooner.

Apples should be carefully picked by hand into baskets holding half a bushel or a little more. They should never be shaken from the trees, nor be allowed to be blown off by the wind when it can be helped. When they are picked they should be at least partially sorted, all the diseased specimens being taken out, and put immediately into barrels. If they are to be sold immediately, or within a few days, they should be carefully graded at the time of putting into the barrels. If they are to be stored any length of time they will have to be graded at the time of shipment, and in that case such a close grading at picking time is not necessary. The barrels may be allowed to stand in the orchard for several days. This gives the fruit time to cool off, which is a matter of some importance.

STORING.

Experience has shown that the most profitable way to handle late winter apples grown in Vermont is to store them on the farm till late in the season. There is seldom any trou-

ble in keeping good apples in good storage till March. In some cases apples are stored in cellars; and though these are fairly satisfactory if the temperature can be regulated to suit, they are not so good as separate storage rooms or houses. It is necessary to have a room with some ventilation and one which is approximately frost proof. But the main question is the one of temperature. The temperature of the storage room must be just as near the freezing point as possible, *and must be kept there.* High temperatures or fluctuating temperatures are fatal to success. A temperature of 33 to 35 degrees Fahrenheit is the best. It is better to go below this occasionally than to go above it. Apples in storage will stand a good deal of freezing, even; and it requires a temperature of 30 degrees for a considerable time to freeze 500 barrels of apples.

The subject of storage is a large one, so that we can not treat of it in full in a short article like this. The man who is going into the apple business on a scale large enough to demand storage for 1,000 barrels of apples ought to have a good storage house; and it will pay him to look the matter up in detail before building.

MARKETING.

Small quantities of apples are sold in the local markets almost everywhere; and there are a few towns in Vermont which absorb fairly large quantities of fruit at fair prices. But in general it has been found that the commercial grower in this state has to depend on the city markets for his outlet. Probably the largest share goes to New York; and we think this is generally the best market for late winter fruit. Boston takes some apples and is occasionally a profitable market, especially earlier in the fall. Sometimes apples are sent to Philadelphia with fair success; and once in a great while consignments are made to Buffalo, Cleveland, Chicago, Pittsburg, Washington or other points. Everything is regulated by the New York market, however.

In shipping apples to New York most persons are obliged to consign them to a commission house; and this introduces an element of uncertainty so great as to keep many farmers out of the business. There are undoubtedly a good many dishonest men in the commission business, and the opportunities for swindling the consignors of fruit are so great that it is not surprising that complaints of fraud are altogether common. Still there are some honest commission men. There are some who have handled Vermont fruit for years and who are personally known to the present writers and to other Vermonters as honest and reliable business men. Unless one has

a sure sale at a good price for his fruit he had better look up the best commission man and ship under his advice. Having found a good commission house, the fruit grower ought to ship to the same consignee year after year. This will greatly facilitate the sale of fruit, providing always that the fruit is good.

In packing for shipment to a distance many persons slacken their consciences with the thought that the fruit will fall into the hands of strangers and the packers will not be held personally responsible for it. In this way they allow themselves to fall into careless or fraudulent packing which they would not attempt in their home markets. This is a fatal mistake. Any faults in packing are always taken out of the shipper; and besides they are made excuses for robbing him still further, providing the commission man has any inclination to take advantage of the case. If some small apples are found in the middle of a barrel the whole lot is marked down a grade lower, and the consignor is compelled to take what he can get for it. Especially if the shipper sends to the same house year after year, a reputation for honest packing and good fruit is ot inestimable value in helping the sales along. This is one of the principal explanations of the fine prices brought by Mr. H. D. Allen's apples, as related at the beginning of this article.

SUMMARY.

The whole matter may be summarized as follows:

1. Select good, well drained land.
2. Plant with good stock, about 40 feet apart each way.
3. Cultivate thoroughly.
4. Fertilize liberally.
5. Prune intelligently.
6. Spray annually.
7. Pick, grade and pack carefully.
8. Store at home.
9. Sell judiciously.
10. Study the business continually in all its details ; and if you are in the business for the money it will bring give it the same thorough attention that you would give to any other business. Managed in that way, commercial apple growing is one of the most profitable industries in Vermont. In fact, there is no state in the Union where it is more profitable.

SOME PRINCIPLES THAT UNDERLIE THE IMPROVEMENT OF LIVE STOCK.

By Charles William Burkett, Professor of Agriculture, New Hampshire College of Agriculture, at Westminster, January 16.

We are all impressed with heredity, or that "like produces like," in the breeding of live stock. There is many an experienced farmer and breeder who has seen well groomed, symmetrical and fine bred animals, and who have concluded to take up the art, expecting to experience the same success. But nine out of ten are disappointed. The barns do not fill up with the kind of animals they anticipated, for after a couple of generations the offspring are much different and inferior to the original stock.

The question arises, "Why is this?" There are several reasons; first, because all animals, as well as their fine qualities and uniformity, have not the ability of adapting themselves to new conditions. Every breed and every individual is influenced by the changed conditions of climate, food and habit. For instance, the diminutive pony and the ponderous draft horse have come from the same ancestor. One was transported to the barren, bleak and stormy islands bordering on Scotland, and the Shetland pony resulted. The other went down in central Europe, where there was a warm climate and plenty of rich and nutritious food, and the large draft horse results. Climatic influences are always at work, but when domestication sets in their influence is partly counteracted by man. Where man works in unison with nature any transformation is accelerated; acting in opposition he counteracts it.

At this point another influence begins. I refer to the law or principle of variation. This simply means the deviation from the established type. It is some new character about an offspring that is not seen in the parental stock. It may be something that should be developed into a strong, valuable character, or it may be just the reverse. Judicious breeding means the notice of a new character and its intensification if something for good, or its elimination if something ill. We are taught today that we should breed from pure bred animals, and many of us are doing so, yet some of our purebreeds are inferior to grades. That is due to the fact that the breeder has not been observing this character of variation. It is natural for animals to deteriorate, and if man does not

counteract the influence that leads to deterioration, it will be sure to result.

There is a third law or principle that now shows its force, viz., atavism, or breeding back, as it is often called. This is the condition when offspring take on characters that were prominent in more or less remote ancestors. Now, if you are improving your breed you may want to get rid of these old characters, because offspring should be superior to all their ancestors; hence, this outcropping of the old is antagonistic to improvement.

Every farmer wishes to improve his breed ; how shall he do it ? I think it undesirable for the majority of the farmers to sell their grade stock. If improvement of a dairy herd is desired, get a Babcock milk tester and test the milk of the herd you have in order to determine the quality of the milk your cows are giving. At the same time, in fact for all future time keep a record of the milk each cow in your herd is giving. This will show what cows are profitable and what ones are not. Sell off those that are not paying for their feed.

Now get a good bull. Not a grade bull, because atavism will be sure to result to the offspring, and then a grade bull is not pupatent. Get a good pure-bred sire, whose mother and ancestors were good milkers. This being the case, the offspring will doubtless have the milk-producing character. Now, how about the pedigree of this bull? Well, lots about it ; the further back it runs the better, because the purer the blood. But that isn't enough ; we have thousands of pedigreed animals that are scarcely paying for their board. You want a bull with a good pedigree, but that pedigree must be backed by performance, that is by ancestors that were milk producers. Now, select for breeding stock only those that have the desirable characters and type of the milk animal ; wedge shaped when viewed from rear, side or front ; thin neck and withers; open backbone; long, well sprung ribs, far apart; prominent pelvic arch; fine bone; loose, mellow skin; large, full but not fleshy udder, that is well attached in front and highly attached in the rear, and thin thighs.

This expresses the ideal dairy type. Breed to it and for it. Select animals for breeding that will transmit these characters. There are yet two more prominent points to be considered: in and in-breeding and cross-breeding. The first, if carried to excess, always results in a loss of constitutional vigor in the produce, yet it is in the direction of fineness of texture, smoothness, evenness and polish. On the other hand, cross-breeding gives increased size and vigor in the produce. So if you are breeding for the market you want in-

creased size and vigor, so practice cross-breeding. But let it be first cross, for when second cross is used deterioration follows. Cross your Berkshire with Chester Whites, or something of the like, or your Shorthorns with your Herefords; they will be ready for the block quicker and at less expense. But let them be pure-bred, Shorthorns or Berkshires; but if you are breeding for breeding animals, do not cross, for this results in coarseness and inferiority. We frequently hear practical farmers and breeders say that pure-bred breeds are lacking in stamina and hardiness. This assumption is not necessarily true. If breeding practices have been followed in accordance with nature's laws, there is no foundation for the assumption that pure-breeds are deficient in hardiness. Where selection has been made constantly with reference to hardiness, strength and endurance where undesirable breeding has been avoided and where there has been no unnatural feeding, pampering, the pure-bred animals have no peers in these essentials and powerful qualities.

I know of nothing more inspiring and grander than the breeder and farmer moulding animals after his ideal, producing a masterpiece as lasting and ennobling as a true artist or sculptor.

TOWN CITIZENSHIP AND ITS RELATION TO RURAL IMPROVEMENT.

By John Gould, Aurora Station, O.

The proper presentation of this subject necessitates the consideration of it from many sides, but if we take up one phase of the question and discuss it from the standpoint alone of the farmer's obligations to his town we shall have best performed our task, so I shall simply confine my remarks to the ground of the farmer's obligations, and what he may do to benefit the town and, in doing this, benefit not only himself but his family as well. Perhaps a better way to put it would be, what can the farmer do to first build himself up, raise himself in the scale of improvement, and, as an outgrowth of this self betterment, assist in the work of town improvement?

The farmer owes the same to society and the realm, nor are his obligations less than that of any other man or class. He is a member of society ; he is a citizen and a creator of public sentiment the same as any other man, and his sense of law, order, decency and all around morality should be no greater and no less than that of the community in general about him. In the country towns the farmer outnumbers all other classes ; many dwellers in our towns and villages, indeed, might well be classed as farmers, for they are directly associated, for weal or woe, with the farm and the farmer. I assume, therefore, that what I may say, well or ill, has an interest to every dweller in the rural portions of the state ; any improvement in the farming element of a township has its almost direct influence upon every person in that township; so what the farmer may decide upon as an improvement for himself should be accepted by the others as an improvement in which they are to share and, as sharers, they should give it their support and influence, and should in turn contribute suggestions for the good of the community.

In the short space allotted to me it is possible to take up a few only of the primary principles that underlie our farming republic; I cannot attempt to trace its history and development, but must begin with the problem as we find it today, and by confessing that we are far short of perfection. The discussion of farm and rural improvement everywhere proves this, and the asking everywhere of the question, "What can farmers do to have better society in home and township ?" is

judgment rendered that the desire for improvement has become more than a latent longing for something better.

In the beginning I may be allowed this argument. It is a common remark that farming does not pay as well as it did a few years ago and scores are asserting that it is manifestly right to abandon it at the first opportunity, and many are in fact doing so. I do not maintain that it is paying great dividends, but what other industry, with capital no greater than that in vested in the average farm, is paying handsomely? How is it in the average township? Where are the shoe shops, the wagon shops, the cabinet shops, the carding machines, the saw mills, the grist mills, the occasional small woolen mill, that were once scattered over our state, in total a score to the township? It is a fact that nearly all of our country manufacturing industries have become extinct because they no longer afforded a living; they were not transferred but were actually left to go to decay, which incurred a total loss of capital; a blacksmith shop or two, a few grist mills a day's journey apart, complete the present list of our country factories. Have the farms suffered extinction in like ways? We are not using fewer manufactured articles, purchased once at home, rather more, in fact, but now they are made far away by large corporate industries, with systematized labor, aided by the most wonderful mechanism, which has reduced the skilled hand that once with rude tools made the closest joint and did the most beautiful ornamental work, to a mere attendant of a machine which, with wondrous execution, fashions the same pieces even more minutely and with the speed of many men.

Now, while the shops of the town have disappeared or been abandoned, the farms have not, and their producing power has in most cases been fairly well manitanied, but the farmer's market now, instead of being almost at his door, is possibly, on the far side of the world; if the farm is not doing so well it is largely because of the shifting of the industrial classes to the great manufacturing centers, which forces the farmer to sell in far away markets; markets which are now — owing to the rapid freight trains and cheap rates -- open to the world and to a competition never dreamed of twenty years ago, that of the bonanza farming of the West, those gigantic specialties of wheat, stock, wool, beef and pork, fairly overwhelm us by their immensity.

But, after all, I reason something like this ; farms and farming will always continue to exist ; we as farmers will continue to do about the same things which we are now doing, the great cities will keep on growing and keep on demanding about the same things to eat and drink and so in-

crease the demand, and if we take the right course our advantages will be increased. To keep apace with the demands of the times it becomes our duty to raise the tone of our towns and to give to our farm homes a better, more attractive look, to cultivate lawns, lay out driveways and make them beautiful. All this would give to the city and town a more harmonious look; to the country dweller it would be a direct benefit, adding largely, not only to his contentment, but to that of his family as well; it would be a restorative, to a large extent, for that vague unrest which sees only in the city the desires of life and its enjoyment fulfilled; it would be a great leveler of the wide distinction that seems to exist between city and country and make the life of the farming towns so much more attractive that we should more nearly retain our own. As there is every year, more and more, an apparent desire upon the part of city people to migrate countryward for homes, a general country improvement — even to the putting on of smart airs — would add much to this movement and attract where now indifference prevails. From these premises I speak for rural improvement societies, a general uplifting in the country and a sentiment that gives hearty endorsement to this purpose, that will assist in giving an air of prosperity, even a citified air of blue blood, about the house, lawn and farm, in place of the so often heard spirit of carping and insinuation, as if it were a crime to pick up, clean up, beautify one's home and surroundings. This carping is a disease that should be eradicated as soon as possible by public sentiment, true and loyal, and the after attainments will be all the more enjoyable.

It goes without dispute that the farm is not paying as well in dollars and cents as it once did. It is true, also, that the farm does not afford great opportunities, except to a small minority, to gain wealth, distinction and fame, but is this not as true of the shop, the store, the machine works or the cloth factory? Where the thousand find employment, the one, only, finds more than a living ; while the thousand live, the one, only, gains what may be called success, but of varying degree, and few indeed are they whom the world stops long to mourn or regret when death overtakes them ; it hurriedly throws the soil above their coffins and then hastens again into the whirl and rush of business to make up what may be called lost time. Still through all this warp and woof of life is here and there a man to whom we ascribe the meagre word, success, which analyzed means this : that which this person did was done well; a measure of thoroughness, an appearance of tidiness, a display of workmanship, whether mental or physical, gained for this person recognition and we

hear of him outside of the little round of local and neighborhood gossip. So with our farmer; if he does things well, is conspicuous in some lines of his work, is above the average, he is a leader in thought and action, though recognition may come grudgingly from some, often from many, still it is this man who is making his mark upon the community and is bettering his locality, in his way, quite as much perhaps as if he taught from rostrum or pulpit. It is out of such material that, in natural ways, comes the thought and example which at last become crystallized into town improvement societies, and the well considered practices and purposes of the few become the accepted desire and the executed will of the many and then we say, "How that town is picking up!"

In this town improvement, from the farmer's side, there is a personal and a community effort, or its reverse, that is closely analogous. Individual men and individual localities are alike ; each is dominated by ambitious purposes, or by a listlessness that means retrogression. All success, however general it may have become, was the effort of some one person in its conception, and its growth has arisen from the fact that others seeing it and admitting its superiority have adopted it, in whole or part, and there has been a general improvement as the result; so I say that, in our farm methods and improvements, success and its effect on the community measured by the attention one gives it and the faith manifested in it as well.

If one goes about his work with the expectation of succeeding he is all the more likely to meet with success ; much more than another who is ever discussing the discouraging features connected with it, continually wishing that he were engaged in something else, and as a rule, saying, "If I could only have a steady salary I would be independent of all trials and setbacks." forgetting that this is a plain confession of inferiority, that living is then dependent upon some other man's ability, when a little resolution and vim might have been this complainer's part in upbuilding and improving. One of the drawbacks in rural life, and it is a growing "habit," is that one becomes willing to lose his identity, to sink his individualism, to seek a place where another can plan for him ; thus the man becomes a machine, and ordinary place seeker, and puts himself where improvement is out of the question and all his faculties are another's to command; then, when this head master fails, as fail he does early and often, the dependent is thrown out upon the breakers and in self-preservation is ready to grasp any plank, even if it be shorter and narrower, affording a much more slender hold on life. In this, the country is not a very frequent sufferer, but in the severe straits into which farming has fallen, it exists, and it

needs a co-operative effort to drive it away and to help each citizen to personal attainment and distinct individuality. I may add that pride of locality is a strong aid toward accomplishing this result.

I know I will be pardoned if I digress at this point to remark, as a side thought, that the present dwellers of our townships are not characterized by the strong, distinct individualism that was once so conspicuous ; an individualism of men and women, an originality of thought and method that made these men and women stand out among their fellow beings like gigantic pines upon the mountain side. These grand old people had thoughts of their own and did not wait for an expression from others ; they never stratified into the indistinguishable average, but each could do and dare for himself ; hence that sturdy intelligence that made, moulded and advanced localities, the far reaching influence which we cannot too strongly admire. Imitation, modified by the progress of the times, would not lessen our value as citizens nor restrict the possibilities of making our lives tell in the bettering of home and neighborhood.

One of the things that prevents the realization of all that is desirable in township improvement is the conception that the farmer's citizenship is builded on lower levels than that of other classes, and that if a farmer cannot attain to great things at a single bound they are not to be sought for in a lesser degree, for only great possibilities should be attempted; another, that all which goes for better home adornment and town prosperity costs money, when the facts are that there are a thousand and one things that can be inexpensively done by hand, and influences set afloat by tongue which, in the aggregate, if put in execution would revolutionize the social and domestic life of our nation and make our roads and their appointments rivals in their rural beauty of Euclid avenue. Did you ever realize that the chief adornments of that famous thoroughfare were made up of four things — grass, trees, flowers and labor—with small stones laid in order for ballast?

It is not half so beneficial for a farmer to originate something great which would sound around the world as to start by example some small reform which would prove epidemic among his townsmen, such as picking up the litter about his house and barns and beautifying his lawn to the point of making it safe to visit him after dark without the precaution of carrying a lantern and a life insurance policy. Well kept homes and tidy appointments about them and well ordered farms mean well kept towns, and when the towns are well taken care of there will be a well looked after state and na-

tion, all the outgrowth of a better ordered citizenship, the foundation of all great nationality.

It is not all of town citizenship to be interested only in national affairs or to attempt great political reforms, (many farmers seem to think that all greatness grows out of politics), but let us first make our homes what they should be and we shall then be better able to keep our town politics pure and town affairs economically administered ; these kept above reproach, it will be easy to have the affairs of state and nation correspond. If the fountain head is pure and the entering side streams governed by the same laws of sanitation, political jobbery and spoilation will cease and the great rural element will be the pioneer and conservator of right and the farm will have won its greatest victory.

Treating our small towns as farming communities and recognizing, as I have, that the interests of the township are held in common, I may be allowed to point out what I think would greatly help us on in citizenship and at the same time promote our common elevation and be the power that would beget many improvements, for it is not improved dooryards alone that we need, but also a general, all around shake-up in our methods and practices and, pardon me, there could be an improvement in our moral tone that would do us no injury.

Our rural neighborhoods could be greatly improved by treating our youthful population as *citizens*, impressing it upon them so that they might realize their responsibility and feel that they have moral and other obligations to carry and maintain as well as older people. This lesson of obligation should begin with the boys and girls in their teens, that they have individual duties to perform in the upholding of law, order, sobriety, decency and general character building ; that the practices that go along with decorum, respect for morality and the common usages of society, look as well when practiced by boys and men, by girls and young women, as when exercised by their elders. The usages of rural citizenship should be respected to the extent that young men should not be excused for sowing wild oats in public view and should forever be debarred the threshing of that crop on the moral commons. I do not believe in prohibiting youthful pastimes and amusements, but the world affords that which amuses and gives ample recreation, without debasement or actual blows at morality, and the country should be the great exhibition ground of this school of better citizenship. This good citizenship should be taught in our homes and in our schools; all good citizenship is founded on the home and the more perfect the conditions of that home the more sure will the "swarming" from the home hive give to the state desirable

citizens. One of our faults in beginning home making is that where we live is not really a home, but a place to stay, a family barn, until the day of wealth comes, away in the future, and during all these years one is forever hearing, "When we get rich we will have as good a home as anyone," forgetting that as the years go by the dream fades and the boys and girls go out into the world with a half-formed idea of the true home and a longing for splendor, which they imagine can only be found in the palatial houses on "the avenue." Here is something that can be remedied ; make a home first and then, as the good Book tells us, "shall all these things be added to you."

We in the country have spasms of reform ; not a steady, persistent quest of it, but when law and decency are overridden to the point of desperation, a move is made, the nuisance is abated and we settle down for a long nap again ; we see this, that and the other wrong perpetrated day after day, often flagrant violations of the law, and weakly wish that some one would make a move, be brave enough to cause a general rising up of the populace, make these things not only odious but crimes, and as such, punishable by law.

Another thing that blunts our country citizenship is the presence of petty rings, political and otherwise, which delegate to themselves all wisdom and dictate, direct and often command to carry their plans. Boards of education that are dominated by one or two members ; caucuses "packed" so that "our men can get the pull," trusting that the fellow who is never seen and whose opinion is never asked will keep on voting straight ; and so on down the line ; people lose all interest, enthusiasm and, almost, pride in their town when everything is cut and dried for them. To know the opinion of "Squire Jones," and who the leading men are to favor, what they want and what they will not have, is to know the final result ; this stands in the way of all town improvement and progress ; such a condition stratifies a town and the mass says: "It does not make any difference what I say or think," and there is no harmony of action. Now and then there comes an upheaval of displeasure, but it lacks strength, the old ways return and a longer interval of rest follows ; then it is that the visitor, after an absence of twenty years, says, "Why ! there has not been a change in town since I left, twenty years ago." Why has there been no change ? What we want is a live town improvement society, with a membership as large as the town, with wide awake interests and meetings held when the wants of the town can be discussed without fear or favor ; we want committees appointed to confer with township authorities and work in accord with them ;

we want this society to be to the town what a board of trade is to a city.

A farming town should have its live farmers' club, holding regular meetings, where the farm and its needs, and not politics, could and would be discussed, farm improvements suggested and resolved upon and this club should hold conferences with the improvement society. A great field for co-operation for these societies might be found along the line of good roads; this is a coming improvement in which everyone should be interested and should do everything in reason to further the matter. A good rural improvement society might, working in conjunction with the proper authorities, do wonders along this line, and do away with the jealous feeling which finds expression in the words, "if the road cannot be fixed in front of my house and farm first it shall not be fixed anywhere." What is wanted most of all is public spirit in the rural districts and the taxation necessary to carry out the improvements will be less burdensome for the unity of feeling. If the whole of a rural community were actuated by the spirit often exhibited by the few, the results would be surprising and nothing could work upon the public spirit as might a rural improvement society, actuated by a mutual impulse to carry out plans for the good of the town; the highway is a splendid place on which to display this impulse.

We could make a most radical improvement by a change in our school system, by abolishing the outlying school districts, where the attendance is very small, lessening the outlay for repairs, fuel and teachers and adopting the more modern idea of concentrating the scholars of the township in a central graded school, establishing a full course of study in harmony with the graded schools of the cities, where four teachers could do better work than the eight or ten now necessary. The high school is an educational power in which every inhabitant can and should take the highest degree of pride, and we owe it to every scholar in the township to let him share in its benefits. The city school is only ten schools merged under one roof and we have the power, if we will use it, to have schools in our country towns that will stand the equals of any in the state. Shall we have this or largely fritter away our educational possibilities?

One of our duties, as citizen farmers, is a little less active observance of the Sabbath and a more general attendance upon church services. Whether or not we are in accord with the expressed belief of the minister, it is a valuable idea for a farmer to get into his good clothes a least once a week and take his place, by presence at least, on the side of truth, right and morality. I do not wish a return to the Sabbath of the

Puritans, but I do say that if some of the work and recreation were left out we would come nearer attaining to good citizenship. It is not so much that we salt the cattle, go visiting, have bicycle meets and the like on Sunday, but the fact that we wait all the week so that we can do them on Sunday. Railway trains run on Sunday, it is true, but that fact creates no excuse for the opening of shops and stores in our rural towns on Sunday morning, or for the boys taking their guns with them when they propose to walk across lots to —— church.

Rural improvement societies should have the idea of better cared for church edifices conspicuous and, if there is no membership in existence to keep up some of these buildings, let the society take hold of the matter and remedy it in some way. Nothing speaks so loudly against a town as the sight of one of these neglected and tumbling down churches. Turn them to some good account and useful purpose, or take them down and beautify the places where they stood. converting them into little parks, with trees and flowers, something to delight the eye if the time for refreshing the soul there has passed.

In our rural towns the pulpit might get nearer the people by adopting the five or ten minute prelude in which the live issues of the day can be discussed without fear or favor, especially affairs at home, and if now and then some of our neglects of duty as citizens were touched upon, or certain lines of desirable action pointed out, in a spirit of fairness and fraternity, I think the following sermon would be all the more enjoyed and we would find very often the line of duty and practical theology running in parallels of close proximity.

While the quality of country and farm homes is as a rule growing better every year, the encouragement of a rural improvement society would be healthful in stimulating more to follow and adorn their homes, not only the outside, but the interior as well ; encouragement would come also from the complimentary words of the passer by and from the inducement for the city dweller to make his summer home in such a locality. Once the summer cottager in a town was looked upon as an invader to be barricaded out, but now the sentiment leans the other way and a rural community points with pride to the fine houses and grounds of the city cousin; soon it is found that his nice lawn is made of nothing but what is found on all farms, only put together in a more harmonious way, and is made attractive by work, not sleight of hand, and so it is often copied by others, until finally the community becomes proud of the suburban appearance of the locality. There might be less use made of lawns for horse pasture and

a few more mowers might be bought. Nothing will quicken town improvement more than the breaking out of a lawn adornment craze ; it will soon extend to cleaning up fence corners, taking the slack out of loose wires; many a housewife will take time to plant flowers about the door and cannas will supersede the burdocks.

Some of our duties have been touched upon in this paper, others might be mentioned, but many of them suggest themselves. We are largely engaged in discussing just now how to make more money, but there is a broader question for the farmers to study today. Our citizenship and what it stands for is broader and longer and should occupy more of our time. The farmer stands not only as the one who is to add realty wealth to this country, but he stands today, as never before, the guardian of the destinies of the country at large ; he stands, to a large extent, as arbitrator of the moral and political conscience of the people ; he is the grand jury to whom is referred year by year the questions that affect not only you and me but the whole population ; thus he becomes the moral tribunal of the nation. Are we as farmers prepared to well decide these questions? Farmers' institutes and similar meetings are doing more to bring about this desirable state of affairs, to foster a better understanding and expand the relations that we bear to each other and the Republic in general, than anything that has happened to us in the course of our lives. May we know our duty and the obligations devolving upon us as citizens and farmers and act well upon them ; may we become a co-operative power for good and benign influences and have the satisfaction of knowing that we, in doing our part, have made our homes, the people about us and the town better and brighter, our social and moral life stronger, more symmetrical and complete with good deeds ; and though few of us may accomplish deeds that shall win earthly fame, yet for the doing and faltering not may we some day hear the words, "Well done — thou hast been faithful over a few things," from the kindest voice in all the universe and gain a continuing peace that shall abide when the earth itself shall have become the dust of the ages.

FROM A CREAMERY AND CHEESE FACTORY STANDPOINT.

Delivered at Vergennes by T. B. Harriott of Georgia.

The leading industries among the farmers of Vermont being dairying, and how to produce the most butter or cheese at the lowest cost, or how rather to produce the largest flow of milk and leave a credit balance on the right side, seems to be the question at issue.

The questions relating to dairying as discussed by the board of agriculture very properly commence with the methods pertaining to the production of feeds, of what constitutes most profitable, most nutritious substances in supplying what is termed a balanced ration ; in short how to utilize the products of the field through most economic methods into milk. The study of the process of milk production, through its various stages, seems almost bewildering, but when we have followed these discussions and have a comprehensive understanding of them, of feeds, how to produce them, of breeds, silos, barns, of the necessary expense and labor in providing for and maintaining a dairy herd, we have passed that perplexing and difficult stage and leaves the remaining process easy and comprehensive, which takes us from the milk pail to the package. The discussion on this subject has taken the dairymen through the methods of producing the most of, and at the least cost, his product of milk as far as the milk pail and there leave him. And it is at this point I take him up and carry the argument through with a few suggestive hints along the line leading to the finished product, which I hope may be productive in awakening an interest in the most simple methods which influence to a great degree the success and standing of the product manufactured.

However well the dairymen may understand the method of producing milk from the beginning to the milk pail, by what seems a little thoughtless carelessness in the handling or care of it, he unconsciously has lost that which he has most striven to obtain, the profit, or a considerable portion of it, and he becomes perplexed. It is the desire of every dairyman that his product reach the best market. He should consider that only the best goods get there, that is, in supplying milk, furnishing the raw material which determines the grade or rank this product must take. He must not consider that all depends on the maker, but should reason that no milk is

qualified to make good goods or to command good prices that he would hesitate to eat himself, which would leave the question of fine goods entirely with the maker.

This question of good milk is like thrashing old straw, it has been hurled at the dairymen from the platform and through the dairy press for years. There is nothing new about it yet the exigency is so great, the trade so exacting, it should be held up to him every time he milks a cow. Dairymen do know and understand the importance of care and painstaking in the handling of milk, yet somehow, or some way, many, very many do not seem to understand what constitutes good, sound milk. It is milk from healthy cows, well cared for, the stables where the milking is done ventilated and kept clean and dry as possible by the use of absorbents, such as straw, sawdust, land plaster, and the persons doing the milking shall be cleanly in their habits, ever bearing in mind that filth once in the milk is always thereafter there, and in every way avoid exciting the cows, and finally the milk put into clean utensils and cooled down to a point where the development of undesirable bacteria will be checked. This is a simple method and requires no special effort.

The extreme competition in the business, the employment of men and boys at the stations who are incompetent to judge milk have in some localities caused the farmers to become careless and indifferent in the care of milk, which is the means of lowering the standard of Vermont products. This has become a condition and a fact which the factories and dairymen will be obliged to meet. The conditions pertaining to the manufacture of fine butter and cheese should be thoroughly understood by every dairyman. Like every article of food manufactured the very essence of success lies in the raw material, milk being an article of food when you offer it for sale at the creamery, cheese factory, or anywhere else. Your self-interest, the consumer and the laws of your state have a right to demand that it be clean, pure and wholesome.

I believe we as Vermonters are somewhat vain and self-conceited in our estimation of our abilities on dairying and inclined to follow old ruts. Nature having placed at our disposal the means whereby we can and do excel, we seem to think because we are in Vermont no one can approach us; but we are going to get this conceit badly shattered before we are aware of it unless we open our eyes to the fact that there is a struggle for first place. The effort to keep the lead must be through practical dairy education.

But a short time ago Canada was not considered by us a competitor. Many of us remember quotations of "Western Reserve," but the quotations were so low compared with our

own we did not consider them in any way likely to influence our eastern markets, but the race between the east and west today is neck and neck.

With effort only can we retain and sustain the standard of Vermont butter and cheese to where Vermont maple sugar now stands unapproacable, the best in the world. Many dairymen wonder how it is some farmers can keep a much larger amount of milk than they have over night and have no trouble in keeping it ; it is always sweet and free from taint, while they dip and dip and in the morning it is sour. There is a secret in this process which I can divulge. Your trouble and extra labor in dipping and cooling to no avail comes about by your cows not being clean. Perhaps the cans have stood all day with milk or whey in them and you have hurriedly washed them to have them ready for milking and perhaps the scalding water to scald them did not scald much. You dip and dip, but the milk spoils. You may think just warm water is just as good ; you think you have washed them clean, they look clean but they are not ; millions of living germs are outside and inside those cans, and when you empty warm milk into such a can they are right there on the ground ready to commence operations, and they will be sure to operate. Be sure the cans are thoroughly cleansed. Nothing short of boiling water or steam will destroy those germs.

The night's milk should be aerated ; if you have no aerator dip it often in hot weather until it is cooled to temperature of outside air. If you set your cans in cold water, dip them just the same. Unless you do the cold water throws up the cream at once and your can is sealed so that no evaporation is possible and the milk is liable to retain an undesirable flavor.

Go to the factory in seasonable hours and when you return, empty cans immediately; have them washed and scalded at once and set out for the sun and air, to purify. And if you go to the factory at night, never put milk or whey in them but simply rinse them in cold water. Avoid filth in every possible way, so that the milk when delivered will retain as near as possible its normal condition. The same milk that would make fairly good butter would make poor cheese, which is accounted for by a portion of the deleterious bacteria going off in the buttermilk and is retained in the cheese casein.

It is generally considered by most farmers that if the milk is not sour it must be all right, and are apt to resent any suggestions from the maker that the milk is off. The matter of sour milk is of little concern to the experienced cheese maker; he has no fear or dread from it. He can reject it, knowing the farmer understands perfectly well what would be the re-

sult from its use. Certain conditions of milk increase the loss of fat and casein in cheese making and result in reducing the yield and quality. These conditions are what are termed taints and are the dread of the maker. There is no source of trouble in cheese making which is so annoying and so productive of serious loss. In general the most common cause of tainted milk is from lack of cleanliness in milking and care of the milk, the causes of which are mostly under control of the farmer, as I consider the prime cause of taints originate from filth from some source.

In the treatment of this subject I have assumed the maker to understand his business, and an exhaustive consideration of these topics has not been attempted.

The enormous milk production in this country necessitates every effort to divert its different products into all channels of trade possible, and the consuming public have an extensive stock to select from.

The trade in dairy products of today are very exacting in quality, and the wide range in price between extra and common should stimulate us to strive for the top mark with all resources at our command.

The demand for dairy products the past season. and the encouraging prospects for the coming season should encourage us in efforts to excel and feel an individual responsibility in the excellence of Vermont products.

We hope that at no distant day our government will give our soldiers a ration of good, honest, healthful American cheese, which would add to the health and comfort of our soldiers and would open a market for our dairy products, which would mean propserity to that industry. It may be claimed that cheese is such a perishable article it could not be used as an army ration without great waste, that it would deteriorate in hot climates so as to soon become unfit for food. This would be true as cheese is generally made for home consumption, but it is not necessary to make that kind to have a good, rich, palatable cheese that improves with age, and that will keep almost an indefinite period when our facilities for refrigerator transportation and cold storage are considered.

To do our best is to accomplish the best results, ever bearing in mind we are catering to a very sensitive and delicate taste. To meet its demands is through everlasting vigilance and effort.

STRAWBERRY GROWING.

By George H. Terrill, Morrisville.

No market garden could be called complete without the growing of strawberries, and no home garden surely would be complete unless it had its bed of strawberries, sufficient to furnish the family with all the berries they could eat for from three to six weeks. People who never tried to grow berries would be surprised to find how easily they can add this luxury to their tables. I believe there is nothing can be grown upon the farm that will furnish so much for the labor and money spent as this one fruit which has justly been called the queen of fruits. Who is there in all the world more deserving of luxuries of this kind than the farmer, who owns the land and bestows the labor many times for others to enjoy. Shall we let the merchants, lawyers and manufacturers have these things and we go without? Think of these things and see if you had not better try a small bed another year, and I shall feel sure that when you have grown them once you will continue.

How shall we grow them for home or market? First go to some grower near by and learn all you can about what kinds do best with him, then if you can, get some plants of him; if not look in the paper for fruit growers and send for catalogues, and look them over and select the kinds your neighbor advised you. Buy your plants and set in the spring of the year on good, well prepared ground. Now, whether you grow them for home or market you want good ground, well fitted, and good care, for there is and always will be a good market for large, clean, nice fruit, and it costs less to raise them than the poor, small, dirty fruit of which we see so much in the market. Costs less because you can get so much more and so much better fruit on the same ground, and so much better price. So I would say, take any good corn ground and fertilize as heavy as you feel you can, though it is not necessary for a good crop to put on large amounts of manure. Still, like almost everything else, the better you feed them the better they will feed you in return.

Old land is preferable when it has been well hoed so the weeds will be kept in check more easily, and the white grub, which is one of the worst enemies, will work less than on sward land. Plow the land deep and make mellow and fine before the plants are put out.

In selecting your plants you must know which are pistillate and which are staminate berries. Plants, like animals, have sex and the laws of nature must be studied and complied with if you would succeed. As a rule the pistillate plants are more productive, yet many varieties have been produced of late years that are self-fertile and still bear well. The pistillate or non-fertile plants want to be set so that every third or fifth row will be staminate or self-fertile, so the pollen can be blown and carried by insects over one or two rows each way.

The same variety will not succeed equally well on all soils and in all localities, and I believe we should set out a few of several varieties and prove them before we go into it on a large scale. Plants of our own raising from the first and earliest runners will do better than plants that have to be shipped very far by express.

I believe there is no best variety of strawberries, for what seems best in one locality will fail in others. Hence the necessity of testing each variety, or of having it tested, in your locality. For home or garden culture they will bear to be set thicker than for field culture.

Two or three feet apart for rows and eighteen inches for hills is right for garden, while for field culture I put them four or five feet in the rows and about the same in the hill. Set the plants so the crown will be just level with the surface of the soil, not too deep or too far out of ground, but just right, pressing the soil firmly about the plant. We usually put the plants into a pail of water and set from there, which is easier than wetting each plant, and the earth will stick to the wet roots and do as well as if wet. After planting the work is only just begun. If in the garden or field, hoe and cultivate often for it is easier to hoe twice without weeds than once with weeds. Keep them down with constant cultivation and hoeing, for weeds and strawberries do not do well together. When the runners begin to start, it is better to keep them cut till July or August and then let enough grow to form plants six or eight inches apart. On my own plants I have used horse manure for winter protection, getting it after heating so as to kill the weeds that may be in it. I put it on to the first snow. I prefer this to straw or boughs ; yet these are good. This serves several purposes. First, enriching the soil, then it holds the frost from heaving out plants, also keeps the soil moist and fruit clean. Spread it on thin and even as you can and cover the snow. And in spring take a fork and shake out the thickest places, leaving the plants to come up through. If for market, buy new, clean baskets and crates and fill them full of nice, clean, large berries, and there is no end to the amount that can be sold.

When people buy fruit they are sure to want more if quality is No. 1. There is good money in raising strawberries if done correctly. Three to four hundred dollars can easily be realized, and many get as high as one thousand dollars per acre, on rich soil and the best of care. Every farmer should raise enough for his family at least, for I believe there is nothing that will add so much to our comfort for the work and expense as a few rows of berries. So I want to say to all to try it and do your part well and see if it does not pay.

BEES AND HONEY.

At Manchester, Jan. 2, by R. H. Holmes, President Vermont Beekeepers' Association, Shoreham, Vt.

The occupation of beekeeping and production of honey, although not a new industry, is comparatively little known by the general public.

It is estimated by the best authorities on the subject that there are one hundred and fifty million pounds of honey produced in the United States annually. Of course Vermont produces a very small proportion of this quantity but when it comes to comparison in quality and proportion to the room she occupies on the map, she stands in the front rank in regard to honey as well as horses, dairy cows, sheep, butter, or even maple sugar.

This being the fact, which every public-spirited Vermonter is ready to affirm, we should ever bear in mind that by "eternal vigilance" only is success retained. It has been said that Vermont is a good state to emigrate from and many that have gone from us to the Middle, Western and Southern States have carried the manhood, integrity and energy, with which they were endowed, among these hills, to the betterment of mankind, as well as improved methods in farm productions, thus making themselves competitors with their native State ; so that in beekeeping, as well as other farm pursuits, one must be continually on the alert for improved methods of caring for the bees, of caring for the honey crop when secured, fitting for market and also placing the crop in the most favorable place for ready and profitable sales.

As has already been intimated, Vermont is not behind other States in proportion to her area, yet her resources for honey production are only partially developed. Nor is her annual production, amounting to some one hundred fifty thousand pounds, sufficient to supply her own population with anything like what would be consumed if the product were evenly distributed. A little arithmetical calculation shows that not more than one-half pound to each person in the State is produced by the State itself. Add to this the fact that a large proportion of the honey produced goes outside to the larger cities and we must conclude that very many individuals seldom get a taste of this most wholesome and healthy sweet. But while it is desirable that the honey which annually goes to waste should be made use of and that the crop should be evenly distributed, thus encouraging home production and

home consumption there is another advantage gained which bears a closer relationship to the agriculturalist than this.

The cross fertilization of blossoms is receiving more attention than formerly and it is becoming known that better fruit is obtained when the best methods of fertilization are used. Although nature has provided other agents to carry out this purpose there is no means practically so effective as the honey bee as it visits the blossoms of all our fruits from the tiny bloom of the raspberry to that of the mammoth squash that adorns (?) the table of our county fairs. I merely mention these facts in passing that it may be better known that the honey bee is the friend and not the foe of the farmer and fruit grower.

There are two erroneous ideas in regard to bee culture and honey production which are quite common. One is that bees "work for nothing and board themselves." The other is that the business does not pay and that it offers no inducement to the man or woman who wishes for an employment to develop their best thought and energy. With the first idea, one who engaged in the pursuit would be likely to fail through neglect to give the bees proper attention and assist them to secure a profitable surplus of honey; and with the second, many would deprive themselves of the pleasure of a most fascinating pursuit and also the pecuniary profit resulting from energetic labor and the use of good judgment.

There are not many localities in Vermont where the variety and extent of honey producing plants is such as to warrant a profitable field for the specialist and it is the purpose of this paper to encourage the keeping of a few swarms of bees by individuals who have other sources of income and might with advantage take up the occupation as an adjunct of fruit growing, farming or even housekeeping, for some women have found the keeping of a few swarms of bees quite as profitable and much easier than rambling over the hillsides to keep the turkeys out of their neighbors' grain field or the young chicks out of the wet grass. It is true that bees have the faculty and sometimes will sting, but the danger from this source is often magnified beyond necessity or actual facts. The beginner should protect the face and hands while manipulating the bees and the most timid can train themselves to deliberate and careful movements and gather interest and enjoyment in the work.

Anyone contemplating beekeeping on a large or small scale should first procure some standard book on apiculture and study it carefully, supplementing the study with actual work among the bees. Take but a few swarms at first and increase as circnmstances will permit. As in all other kinds

of business, some will develop faster than others. More bees can be kept in some localities than others. An occasional visit to some practical apiarist will aid materially to success. There will be ample scope for study, observation and reasoning faculties. Study the habits and requirements of the bees. Observe the flora of your vicinity. Find out when the bees get the most honey and from what source and how long it continues ; then another season you may be able to prepare to get the most from that source.

Swarms should be kept strong in numbers and in normal conditions. How to have a hive full of bees and ready for action is as important as that a general of an army should have his men in good health and spirits and under good discipline when the enemy approaches.

The honey season in Vermont is short at the best and the time for procuring surplus honey is sometimes limited to a few days, and in no occupation is the old maxim more true that our dish should be right side up when it "rains porridge." Even then there may come a season like the one just passed (1899) in Vermont, when it does not "rain" honey at all, but such occasions are the exception rather than the rule. On the other hand, there are seasons when the proceeds are great in proportion to the labor and expense involved and anyone contemplating this branch of farming must expect success and reverse to follow in quick succession.

To those who are interested in the subject, perhaps a few general directions as to the care of bees and honey may not come amiss. Beginning in the spring as soon as the weather is warm enough for the bees to fly freely and are gathering pollen, and possibly honey, from the wild flowers, the hives should be opened and examined to see that there is brood in the combs, indicating the presence of a good laying queen; also to see if there is plenty of honey (of which there should have been an abundant supply the fall before), and if there is an accumulation of dead bees or filth on the bottom of the hive ; it will be a help to the bees to remove all such. If a swarm fails to have a good queen early in the season they should be provided with one or failure is the inevitable result If there is a lack of honey, there should be fed a sufficient amount of honey or sugar syrup to encourage brood rearing, for this is the time to work for increase of bees that the number may be sufficient to gather the honey which may come later. Perhaps the most important requisites at this season is a good queen and plenty of food.

The apiarist should see that these conditions are kept up till the main honey flow, which in some seasons does not come until the middle or last of June in Vermont, and then the

surplus boxes should be put on the hives, giving the bees an opportunity to store honey where we may get some returns for our labor and expense. The boxes should be taken from the hive as soon as completed, or as soon as the honey flow stops, and put in a warm, dry and well ventilated room, and kept under those conditions till the honey is ripened sufficiently to be in the right condition for market. When the honey increases beyond the demands of the family, study to dispose of the surplus to the best advantage. Do not go to your nearest grocer and sell the honey for less than the wholesale price, as is often done. You do not take your butter in a wash tub or dry goods box to the store and offer it for 12 cents, when you can put it into a neat package, made expressly for the purpose, and send it to market and get 18 cents. Honey should be handled with the same painstaking care. The boxes should be cleaned and kept from dust and insects. Neat crates should be provided, holding about twenty boxes each, and the honey carefully graded and packed, either with glass fronts or cartons neatly printed.

At the close of the honey season, there should be an ample supply of honey in the hives for the winter stores needed by the bees. If honey is lacking, sugar syrup should be fed as in the spring. The difference being that in the spring we feed to encourage brooding and in the fall we feed to keep the bees from starving during the winter. Before cold weather sets in the bees should be packed in double walled hives, or put into a dry, frost proof cellar, to protect them from the severity of our Vermont winters.

I have already said enough to convince you that bee keeping is no child's play; that it requires skillful labor and good judgment. I have said very little of the profits of the business, as that has often been overdone, inducing many to take up the occupation, only to meet with failure.

But many farmers have added this branch to their other interests and found it most profitable of any for the amount of labor and expense involved. Many who have not strength to grapple with the heavier farm labor have taken uo this work and found a healthful and pleasurable occupation with remuneration sufficient to induce them to continue the business for the profits alone.

The old saying holds true "that any business is good business, provided it is well followed."

RUTLAND COUNTY FRUIT REPORT.

By D. C. Hicks, Vice President for Rutland County. Read at the Burlington Meeting, December, 1899.

Rutland County, topographically considered, is in the main well adapted to the growing of the fruits of the Champlain Valley. A few of the mountain towns, Mt. Tabor, Mt. Holly, Peru, Mendon, Sherburne and Pittsfield are more restricted in the range of varieties which are suitable to their elevation, but many good orchards are found in these towns. The soil of the county is diversified. In the north central and western section, clay and clay loam abounds; in the southwestern portion, black slate soil predominates; and in the south central and southeastern, lime loam and sandy loam is much in evidence. The largest orchards are found on the clay loam and black slate soils, but orchards of considerable size are found in the other sections. The sandy loam soils of the south central part are well adapted to the growing of the small fruits and increased attention is being paid to this branch of fruit growing. The strawberry leads, followed by the raspberry, blackberry, currant and gooseberry. The home markets consume all the fruits raised, except in years of heavy crops, a few apples find a market outside. In such years, much of the surplus apple crop is made into cider. The evaporating and canning industries have not as yet been established, although I believe in the best apple sections one or more such well equipped plants would be successful.

The cultivation of the soil planted to tree fruits is not generally practical. Better results would come to the owners if more attention was paid to this, with pruning and fertilizing. Where fertilizers are used, ashes and barnyard manure are the two forms applied. It is usually done in the fall and winter.

Pruning is mostly done at this time and in early spring. Spraying of fruit trees is receiving more attention, and the necessity and value of such work is each year becoming more evident to oar orchardists.

The different varieties of fruits grown is legion, but if I were asked to name four varieties in each class best suited for commercial purposes, would name the following: Rhode Island Greening, Northern Spy, Hubbardston, Nonesuch and Spitzenberg apples; for pears, Anjon, Tyson, Vermont Beauty and Sheldon; plums, Lombard, Monarch, Grand Duke and

Yellow Gage; cherries, Dyehouse, Early Richmond, Montmorency and Morrello. In small fruits: Strawberry, Haverland, Beder Wood, Brandywine and Warfield; blackberry, Eldorado, Ancient Britton, Snyder and Agawam; red raspberry, London, Miller, Cuthbert and Marlboro; black and purple, Gregg and Palmer, Shaffer and Columbian; gooseberry, Houghton, Red Jacket, Smith's and Pearl; currant, Cherry, Fay, Red Cross and White Transparent. Outside of this list there are many old varieties that are valuable, and the list of new and untested varieties is large and increasing, and promises many valuable additions for market and home use. While I can not in this informal talk devote time to a discussion of these new claimants to places in our gardens and orchards, yet at some future time I hope to give a short paper before this society on this topic alone.

The insect foes that do the most damage are the forest tree and tent caterpillars, codlin moth, bud moth, the different families of borers and the railroad worm. The two last named are the most serious pests. The fungus diseases that have to be fought are the different forms of blight, plum rot, black knot and the canker of the apple. In the small fruits, strawberry rust and anthranose are somewhat prevalent, less so in the last year than for some years before. The same may be said of pear blight and black knot, but I fear that the apple tree canker is on the increase in our county. The Baldwin seems more liable to its attack than any other variety. In this short report I shall be unable to discuss methods of fighting these insect and fungus foes, but at any time will answer to the best of my ability any question touching these points.

The fruit crop of the present year has been a light one in Rutland County. Apples hardly more than 25 per cent. of a full crop, pears and cherries light and plums less than one-half crop. In small fruits, strawberries made 40 per cent. of last season's crop, raspberries 20 per cent., blackberries and currants 50 per cent. of an average crop. Prices for all kinds of fruit ruled high, an advance of 10 to 25 per cent. over last season's good prices.

The outlook for next season at the present time (Dec. 12), is not as a whole promising. Spring set small fruits will not average 60 per cent. of a full stand, and our orchards, which in the past two or three seasons have been ravaged by the forest tree çaterpillars, have not set fruit buds but to a limited extent. The cherry and plum seem the most promising in this respect and should the coming winter and spring prove favorable, I look for a fair crop of these fruits. And right here I wish to urge the fruit growers, not only of my own

county, but all other counties in the state, to pay more attention to the growing of these two fr uits. The trees grow rapidly, are easily handled, bear early, fruit brings good prices and our market demands so much exceed the available supply that years cannot catch it up. Three dollars and twenty cents per bushel crate is about the lowest price for choice fruit at my farm. Don't be alarmed if the birds pick a few cherries. They nearly always select wormy fruit and the noxious insects they capture will more than offset any damage to the cherry crop. At our next annual meeting let every county in the state be represented and a short report of horticultural conditions given.

"THE MAN WITH THE HOE."

By JOSEPH L. HILLS, Member of the Board.

The writer does not intend to discuss either Millet's masterly work of art nor Markham's poem. "The Man With a Hoe" for us to consider is neither the painter's French peasant nor the poet's "brother to the ox," but the American tiller of the soil. What does he with his hoe? Is he, as Markham indicates, brutalized by its use? The poet votes yea, the writer nay. If its user knows not what he hoes nor why he hoes, if his work is mechanical and unthinking, the poet may be right. If, however, he knows the reasons for tillage, how and why he cultivates his crops, if intelligence is linked to industry, agriculture becomes an ennobling pursuit and he who votes affirmatively is forever wrong.

The study for us today is not of the man, however, but of the hoe, the primal instrument of cultivation. We shall study the work of the hoe, the plow, the harrow, the cultivator, — cultivation, its whys and its wherefores.

What is tillage? It is the fitting of soil to crop needs, the promotion of "condition."

Why is tillage necessary? The principal reasons for soil cultivation may be summarized as follows:

1. It enlarges the total surface area of soil particles, thus presenting larger surfaces to soil water, to root acids, to soil ferments and to weathering influences. This means more soluble plant food.

2. It areates the soil, promoting soil breathing.

3. It favors the growth and action of desirable forms of bacterial life and hinders those of species which are often harmful.

4. It permits a wider and easier root penetration, larger foraging powers, and the production of more humus.

5. It admits of a closer control of the water supply.

6. It kills weeds, an important matter, not because they are weeds, but because they are consumers of water and plant food.

Let us elaborate these points somewhat, for if they are apprehended the farmer will till the more inteligently and successfully.

Tillage frees plant food. A pound of granulated sugar will dissolve more quickly if stirred in a gallon of water than will a pound of sugar in lumps, and the latter more quickly

than a pound of loaf sugar in a single lump. Why? Simply because there is a larger surface area for the fluid to attack when the sugar is granulated than when it is in either of the other two forms. If some force broke the lump and loaf sugar into fine particles they would dissolve more quickly. Similarly, if through plowing, harrowing, spading, cultivation in general, the soil particles, already minute, are still further subdivided and made smaller, their total surface area is increased and the opportunity is bettered for the battery of solvents present in every soil to attack and to dissolve the plant food.

The natural plant food of a soil, if it could all be made available as needed, would last indefinitely; but it is mainly insoluble. Had it been the plan of creation to make it all available at once it would have been leached out long ago. Continuous cropping without restitution of the plant food removed, however, depletes the stock of soluble ingredients. This condition may be remedied by the direct addition of available plant food, by tillage, or both. It is quite possible by thorough tillage to greatly increase crop production, in part because of the fining of the soil and the greater chance for solution.

Nature's soil solvents are water, the root and humus acids, nitric acid and nitrates, etc. They act in conjunction and their work may be hindered or favored according as opportunity is afforded them by tillage.

2. *Tillage and soil breathing.* A good agricultural soil breathes, inhaling and expiring air as does an animal. The rush of air is sometimes observed in wells in open soils to be strong enough to blow a flame. This soil breathing is caused more particularly by alterations in air pressure, barometric changes and by changes in temperature between day and night. It presents new air to the same soil particle and promotes its disintegration.

3. *Tillage aids bacterial growth.* The effect of the air on the growth of the lower organisms is most important. All soils contain bacteria, minute plants of microscopic size. Certain species are beneficial, others detrimental, and yet others, so far as are known, are without effect. As a broad and general rule, those which are harmful thrive best where the air is lacking. Hence in proportion as tillage opens up a soil and increases its breathing, within limits, its aerobic or air-loving bacterial life is favored and its anaerobic or air-shunning bacterial life is hindered.

Among the bacteria which are indispensible to plant growth, whose activities are in some measure affected by the amount of air which is available, may be mentioned those

which have to do with the nitrogen gathering properties of the leguminous plants, like clover, peas, beans and the like, and the nitrifying and denitrifying bacteria which have to do with the fitting and unfitting of nitrogen for plant uses.

The farmer long ago observed that the growth of clover bettered instead of impoverished a soil. It remained, however, for the investigator to search out the reason for this phenomenon. It was found that certain classes of bacteria have the habit of locating themselves upon or rather within the roots of the pod-bearing plants, of forming thereon little enlargements called tubercles or nodules, and of living therein. This copartnership is established for their mutual benefit, each plant helps the other. The minute bacterium is housed and fed by its host, the clover plant, and it pays rent in the form of nitrogen. The clover or pea or bean plant builds up the bulk of this structure from the water and carbonic acid of the soil and air. It leaves to its little renter, however, the gathering of the nitrogen for making protein, the tissue builder, from a source which it alone can reach. So far as is now known, none but the leguminous plants afford house room to this class of plant life, and none but they are able to draw on the inexhaustible bank of the atmosphere for their nitrogen supply.

The relation of bacteria to nitrification is also important in this connection. Plants can absorb their food only when it is dissolved ; and a bit of dried meat or blood, a grain of cotton seed meal, or a fragment of manure is useless as a fertilizer unless it become available. The nitrogen these contain is insoluble, but nature, through its agents, the bacteria, gets to work upon it and transforms it through various stages into soluble forms, fitted for plant needs. The germs which bring this about are known as nitrifying bacteria. Just as there are in the world of large things men whose pleasure it seems to be to thwart the work of others and to work mischief and destruction, so there are present in every soil de-nitrifying germs, which undo the work of the nitrifiers, which destroy the food thus made ready for plant uses, which reduce it again to nitrogen and oxygen, which are useless in that shape.

It is important that the farmer appreciate the point already mentioned and here reiterated that usually the nitrogen fixers and nitrogen fitters, the useful germs, thrive best in well drained, well tilled, well aerated soil; and that the nitrogen robbers, the destroying germs, lurk in damp soils, where air is relatively lacking. Drainage and tillage, therefore, serve to develop the one and to hinder the other.

4. *Tillage sends the roots rambling.* The root system of a plant is as important as is leaf growth. A plant which is

shallow rooted is less able to stand droughts or adverse circumstances of any kind. Its opportunities to appropriate water and plant food are lessened and its growth of necessity stunted. If however the seed bed is mellowed by cultivation so that the roots may ramble as they will, they will search out and utilize more food and water. The quantity of water needed by a crop is so large and the amount in a given area of soil so small that the foraging power of a plant for water needs to be encouraged to the utmost. Proper tillage persistently carried out, may enable a man to double his acres for crop growing purposes without increasing the area on which he pays taxes. This does not mean deep plowing at once, but the slow, gradual deepening of the furrow, taking a fraction of an inch at a time. Twenty or more years should be consumed in attaining a full depth. T. B. Terry of Ohio has spent twenty-seven years in deepening his arable soil four inches. But by the frequent use of the cultivator, the total surface of soil particles exposed may be increased and thus the available acres be really enlarged. A full crop on one acre is better than a half crop on twice that area.

5. *Tillage saves water.* The cultivator may be used as a watering cart, may serve in lieu of a rain storm, and may become a first rate substitute for an irrigating ditch. What does this mean? It means that a penny saved is a penny earned, that a drop of water in the soil is as good or, indeed, better than one falling from the sky, that it may be saved and applied to plant uses if one will. In order to grasp this idea one needs to know somewhat of nature's methods of handling soil moisture. The water in any ordinary soil is found permeating it throughout. Some way below the surface, varying according to conditions, is located the permanent standing water. This is at the same level as the water in wells and is known as the "water table." When rains fall or snow melts there is percolation or draining of water downwards towards this lower level. When the rains stop and the snow is gone, the water begins to move in the other direction upwards. This movement which seems contrary to the law of gravitation, is caused by what is known as capillary attraction. This is the power that causes a blotting paper to absorb ink or water, or a lamp wick to become saturated with oil. The curves of the surface of water standing in a narrow glass tube are also caused by this peculiar phenomenon. The soil grains do not pack together without crevices but are more or less loosely piled together. The minute spaces between these particles form long, crooked tubes, up which the soil water is drawn by capillary attraction.

The kerosene lamp and the soil are strikingly alike in

this matter. The wick and the soil, the oil and the water, the flame and the sun's rays, are similar. As the oil is drawn upwards between the minute crevices of the thread of the wick until it reaches the top, so is water drawn upwards in the soil through its small tubes. If the lamp remains unlighted the oil is not vaporized and lost ; if it is lit, more oil is pulled upwards to replace that which is consumed, until all is gone. Similarly, if the burning sun rest upon, or scorching winds blow across a soil, its water is sucked out, vaporized and lost.

Now, while this force of capillarity is of the utmost importance to plant growth in that it keeps bringing water and plant food from levels lower than plant roots can readily attain, there are frequently cases when this water is largely vaporized from the surface of the soil and an insufficient supply afforded the plant. Cultivation may be used to control this matter, to lessen the loss by vaporization, to markedly increase the supply available for plant uses. How can these things be? Let us study one of the peculiarities of capillarity. The smaller the diameter of the tube, the easier the water will "flow up hill," the quicker its transfer from lower levels, and the greater the loss. On the contrary, if these tubes be either widened or clogged at the surface, the water can rise to the point where they are widened or obstructed and no further. Prof. Roberts of Cornell has illustrated this point very nicely. A boy at the bottom of a dry stoned well, if the well was narrow enough to permit him to dig his toes and fingers in between the crevices on either side were no boy if he could not readily climb out and escape. If, however, the well widened out near the top or was covered with rubbish, the boy would climb so far and no farther. The shallow cultivation of a growing crop repeated every week or ten days, or after small showers, will keep an earth mulch, a fine dust blanket, on the field, and will widen some and clog other capillary tubes and save for plant uses a large proportion of the water which would otherwise be vaporized from the surface of the soil.

This water, now percolating under the influence of rain, now rising by capillarity, keeps the roots bathed in a dilute solution of plant food brought from places they cannot reach. If vaporized, it places this plant food on the surface, or so near it as to be either a detriment, as in the alkali soils of the west, or useless. Crops need vast amounts of water. Experiment has shown that for every pound of dry matter the common field crops contain, they need, in order to make their proper growth, from 200 to 500 pounds of water. This may be supplied with relative ease by irrigation. Rains some-

times afford this, but as crops are ordinarily managed, the full amount is seldom obtained in this way. Cultivation, persistent shallow cultivation of growing crops, goes far to render the maximum possible. The writer saw in a California valley in July, 1899, luxuriant fields and orchards, decked in vivid green, on which no rain had fallen for a hundred days and to which not a drop of water had been added by irrigation. The earth mulch or dust blanket lay all over the farm and was maintained by frequent tillage. Below it, two inches or so down, the earth was moist with capillary water, stopped there at the root levels by the husbandman's direction. Near by was a hard baked soil, which, untilled and uncropped, had lost its water and was practically a desert. The Bible tells us that Joshua commanded the sun to halt in the skies. On this California farm the work of the sun was halted, so far as it was adetriment, by the application of the teachings of physical science to practical farm affairs.

"And the desert shall blossom as the rose." Care should be taken not to cultivate deeply, lest the roots and root hairs be broken. This is worse than no cultivation, as the plant's water pipes are thus destroyed. Shallow tillage, oft repeated is the receipt to use when conditions do not favor the furnishing of a maximum amount of water to a crop in the right form and at the right time.

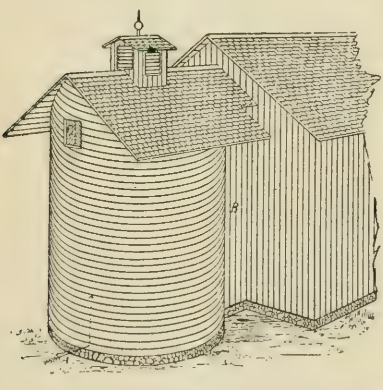
6. *Tillage should be used to kill weeds; not because they are such, but because they rob other plants of food and drink.* The writer heartily seconds the resolution offered some time ago by a New York man: Resolved that weeds are a great blessing to the intelligent farmer. Weeds in the tillage land have stirred many a man to cultivation, who otherwise would have neglected this duty; and this neglect would have entailed a shortened crop, because the five beneficent effects already cited in this article would not have been brought about. Weeds are guilty and should suffer death, not because they are plants out of place, which after all is the true definition of a weed, but because they consume the water and plant food belonging to the crop. They are robbers — sometimes murderers — and should die. In the pasture or the mowing the weed problem is a serious one, but not in the tillage land. The farmer who fails to kill them makes the double error of fostering robbers and failing to better his soil; he who cultivates, kills them and improves the chances of his crop in at least six different ways, by adding to the available plant food, by helping the soil breathe, by promoting bacterial life, by enlarging the chance of root development, by saving soil water and by translocating from lower soil layers the best of the plant food they contain.

Commercial fertilizers are well enough in their way. Barnyard manure should be carefully husbanded and more and better manue should be made. But their value is apt to be overestimated and that of thorough tillage as a factor in crop production underrated. The commercial fertilizer supplies nitrogen, phosphoric acid, potash and lime ; the barnyard manure, all of these as well as humus. But tillage does more. It develops and betters the plant food stock on hand, it gets at and unlocks nature's doors, frees these elements already in the soil, and, moreover, its relation to the water supply, which above every thing else, perhaps, is the controlling factor, is of the closest kind. As a water saver and bacteria promoter alone it is worth more than it costs ; and the freed plant food is "thrown in." The old Roman worthy, who said that the three things most needed to insure a good crop were tillage, tillage and tillage, had the right idea. Would that more American farmers would follow his advice!

SILO BUILDING.

Points from the lectures given in February at the Vermont Institutes by JOHN GOULD, Ohio.

One of the valuable things about the ensiloing of our crops is that the cost of silos is yearly diminishing and the efficiency of them increasing. It seems that every new "discovery" about them, adds to their simplicity, and places them more nearly within the reach of every farmer who has suitable land on which to grow four acres of good corn. So far as it relates to the silo itself, it would seem that the round silo is to supersede, in the larger number of cases, all other forms, and with few exceptions, the stave and hooped silo is the one oftenest built, and giving the best of satisfaction. It is simply to keep the air from penetrating the walls and bottom, that gives keeping and preserving properties to the silage, the oxygen of air from the mass, once expelled, and preventing any fresh ingress of it, there can be no considerable increase of germ, or destructive bacterial life, and so far as known, a well sealed pit of silage would keep in an excellent state of preservation for ten years.



What the farmer wants to know is how to get the best silo for the least money and labor. In this the stave silo, built of 2x4 inch stuff for staves, close jointed, but not matched or beveled, and hooped with four breadths of the coiled wire Page fencing, and set on a leveled foundation without cut stone or brick foundation, gives a man the most for his money and labor. In this brief article, with its illustrations—for the latter we thank the Ohio Farmer, Cleveland, O., for their courtesy in donating their use — we shall only have to do with the one pattern of stave silo and its setting up.

First as to material. This depends upon local supply. Hemlock, free from shakes, is a good material. Pine, with solid knots, pitch pine and similar woods are all in evidence. It cheapens a silo often to use shorter staves than the entire

depth of the silo, by splicing a long and a short stave with a square end cut, sawing an inch into the end of each and using a galvanized iron tongue 2 x 3½ inches to join the ends. It is not found that a silo is any better by matching or beveling the staves. The best way is to joint the edges, so that they will come uniformly together all the way up, and when the hoops are on, and drawn up, the "pinch" of the inside corners of the staves will make an air closed joint. It is not supposed that any better foundation can be made for a tub silo than the one depicted in Fig. 3. The ground where the silo is to set is made level and the silo built first, and hooped. The silo is then stayed up by putting cross boards, four of them, under it and then a ditch a foot wide and as deep with slope sides meeting 12 inches below and directly under the staves. A two inch drain tile is laid in the ditch, with outlet provided for to discharge surface water. A little coarse gravel is covered over the tile and some flat stone of equal thickness laid in and the silo is then let down upon these stone and the trench is filled in with coarse gravel cement, and upon each side of the staves as shown in Fig. 3, in which A inside silo, B staves, C trench filled in with cement, D outside level of ground, E soil from inside of silo drawn from center and banked on over the cement so as to make silo kettle shaped. For the floor of silo, nothing is better than well pounded down clay, unless water and rats have to be kept out, when a cement cover will be needed on over the clay.

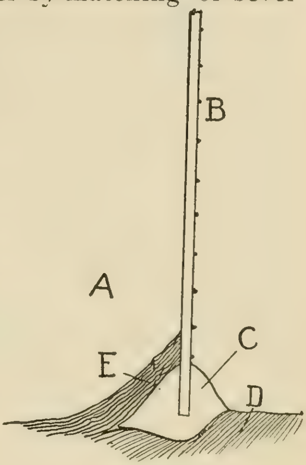


Fig. 3

In setting up a stave silo it is necessary to make a staging, so that it will nearly conform to the cylindrical form of the silo. To do this, it is best to set four posts solid in the ground close to the outside of the silo, and mount on this a frame as shown in Fig. 6. This can be readily made of 16-ft. boards with the corner boards as shown. Make the inside measure of this frame just as large as the outside diameter of the silo will be, so that it will touch the frame at eight points. Start by tacking a stave to the frame, then add staves, toe-nailing them on to the other at top and bottom with one nail at each end of stave, and so on round. The platform should be at least 12 feet from the ground, and stayed so that it cannot twist or sway. The hoops can then

be put on. and as they are tightened, are pounded into place, and trued up so that the inside surface shall be as true as possible.

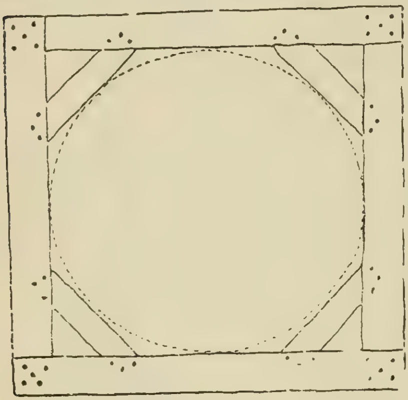


Fig. 6

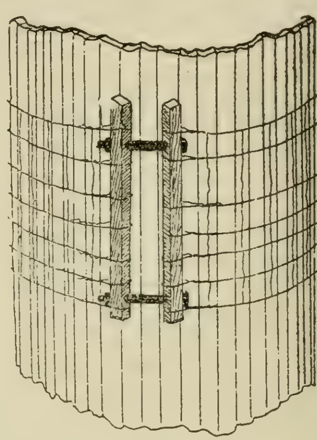


Fig. 7

For hoops, some think the $\frac{7}{8}$-inch rod with burrs at both ends, using a 4 x 4-inch scantling long enough for two hoops, makes the best tightener on a silo. Some think the flat hoop the best. The later idea is the 52-inch wide Page fence, four bands to a silo, for hoops, as described above. The method of drawing these bands together is shown in Fig. 7, the wire being snugly wrapped about two 4 x 4-inch oak scantling 56 inches long, so as to come (when put about the silo) within about 10 inches of each other, and are then brought together with two stout bolts, with double burrs. See Fig. 7. Incidentally, these bands are placed about 17 inches from each other so as to have a manhole between each as illustrated in Fig. 8. When the silo is complete a manhole 16 inches square is marked out, and two cleats nailed on to hold the staves firmly together. The "hole" is then sawed out so as to have a $1\frac{1}{2}$-inch bevel, as seen in dotted line, and is put back into its place, and makes a perfect air-tight door, only needing a little curtain of

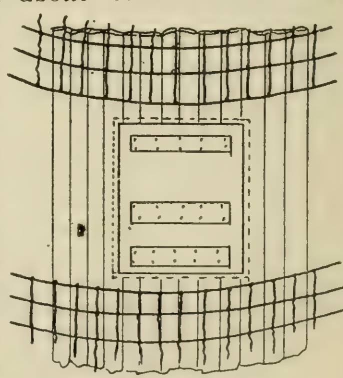


Fig. 8

tarred paper placed over it on the inside, when the silo is filled.

The great value of the wire hooping consists of the adaptation of the wire to the different silo needs. Pulled as close as may be, these coiled wires will still give slightly as the silo staves swell from contact with the silage. When the silo is empty, and rod and band hoops are allowing the silo to actually fall down because the hoops cannot conform to circumstances, the fence hoops with their great torsion keep the staves closely together all through the dry months. The strength of one of these hoops is enormous, 28 tons on one wire alone, so that no fear need be held as to any weakness of these hoops, if good hard wood clamps are used, and ends made secure.

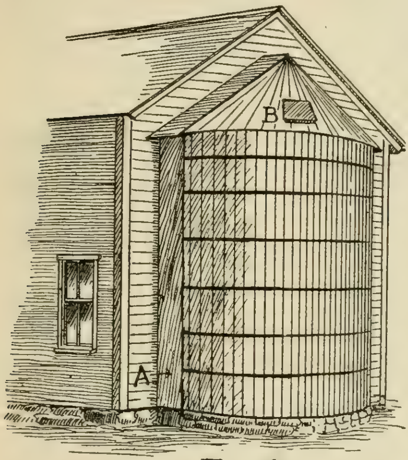


Fig. 9

Fig. 9 is an illustration of how a silo can be pretty well covered when built outside of the barn, and at the same time "stay it" so that there will be no danger of being blown over, which last is the weak point of outside tub silos. The silo is placed against the barn so that the silage is thrown on to the barn floor, practically. 2x4 stuff is fastened to silo side and to the barn, and then covered as shown, and so makes about all the double walling a silo needs, as the danger and damage to silo and silage by frost is greatly overestimated.

For a cover to protect the silage until wanted, nothing has yet been devised that excels a cover made a few days after the silo has been filled, by thorough tramping of the surface, then putting on 100 gallons of water evenly over the surface, and sowing on, and raking in, a bushel of oats, and growing a cover. They will make rapid growth, soon die, fall down, and together with the roots make an air-tight cover.

FARMERS' EDUCATION.

Delivered at Salisbury by JOHN E. GALE, Guilford, Vt.

There was once a time when if a farmer had two sons, one bright and one rather stupid, the brighter one would be educated for some profession and the other kept upon the farm, as being good for nothing else; and it was not supposed that a farmer had any use for an education.

Farming was formerly regarded as a vocation, rather than as a business; as a mere servile occupation rather than as a great and necessary industry. But now, in view of the progressive state of all branches of the agricultural science, the successful farmer must realize that he has a business enterprise on hand, and not merely an occupation. And as a rule, it is in business management that we are lacking, rather than in the ability to make our farms productive.

It is one thing to produce a good crop, and another thing to convert that crop into money. Farming for a living is one thing, and farming at a profit is another. It must be conceded that to successfully manage a farm requires the same degree of business ability that is required for the successful management of other branches of business. Therefore we assume that the farmer who has carefully prepared himself for the business in which he has engaged will achieve success more readily than he who has gone into business without that preparation. Now, there are two ways of getting into business; one may begin at the bottom and work up, or he may begin at the top and work down. We will not consider the latter, as the former method is the more satisfactory.

Preparation for a farmer's life, then, requires some education. What should this education comprise? What is necessary, or advisable, for him to know? Let us begin with the common schools, and let him pursue all the common school studies, giving special attention to those in which he is particularly interested, and to those which immediately concern him and his business.

If I were to prescribe a course of study for the young man who is to follow farming, I should recommend, in addition to the common school studies, a short course in bookkeeping and a course in business law. Bookkeeping is an essential part of the proper conduct of all business, and its universal neglect is one of the greatest mistakes of our farmers. No man can

safely do without his account books, even if his transactions are all upon a strictly cash basis, and to keep a simple set of account books in a plain, business like way is one of the most necessary things conceivable in connection with our farm management. In connection with this I want to suggest that every farmer should have his desk, and a regular place to keep his books, pens, ink, stationery, bill heads, receipts, letters and everything of this kind, and a few minutes at the desk, at the end of the day, should be a regular part of every day's work. Write up your account book, look over your mail, write your letters, take care of your business. A fair knowledge of ordinary business law is a most valuable acquisition to the farmer's education. It will save him time, annoyance, and oftentimes great expense. It is not to be expected that farmers will take a regular professional course, yet a knowledge of the ordinary legal forms and commercial practices is exceedingly useful, and ought to be considered a necessary part of the farmer's education.

In most country towns the farmer is called upon to take charge of the affairs of local government, and a practical knowledge of its functions is a duty which good citizens ought not to neglect. If we would interest and educate ourselves more upon subjects of local government, questions of public interest and public policy, and acquaint ourselves with the recognized rules of debate, there is no reason why we as farmers should not wield the power that is now almost wholly monopolized by professional men, who are permitted to manage our legislative bodies and to dictate the policy which we are to pursue.

The practical education of the farmer may be improved and strengthened by careful observation. He should be continually on the alert to learn anything which may be of value to him. The agricultural fair, if rightly managed, is a most valuable educational factor. If others can produce better cattle and better crops than you do, you want to know it and inquire into the whys and wherefores. You may learn that there are better breeds, better varieties or better methods than yours, and if a better product can be had at the same cost you should lose no time in learning how. If you are passing along the road and see an unusually good crop, inquire about it. You may learn something worth dollars to you. We are never too old or too well informed to learn a little more.

The farmer's club and the grange might do wonders for the farmer if he were only willing. Practice in the discussions in club and grange meetings will supplement the education in a way that no amount of study can do. It is not ex-

cess of natural ability, but the trained mental faculties which give professional men the advantage over those who work with their hands. It may be that the farmer is naturally as able as his brother, who is a preacher, or a professor, or a lawyer, perhaps. In fact it has been said that it requires greater ability to successfully manage a farm than to make a successful lawyer, for the lawyer has to do only with the laws which man has made, while the farmer is continually dealing with the laws which God has made, and it takes a mighty smart man to interpret the Almighty. The farmer should take advantage of the research and experiment which are constantly being made at his expense, that is, at the expense of the government, state and national.

The agricultural experiment station bulletins, reports of the board of agriculture and of the state dairymen's association contain a great deal of practical information and may be had for the asking. The government year books and a long list of agricultural publications can be had either free or at a merely nominal cost. Our books are our most valuable tools; we can not afford to be without them. Let us make a continual study of our business, adopting the methods of the successful, and avoiding the mistakes of the unsuccessful. Let us search out our own mistakes. One branch of our business may be taking away the profits of all the rest. The labor problem, the power question, insurance extortion, taxes, conveniences and improvements, — these and many other subjects may be profitably considered.

The law of compensation is as firmly established as is the law of gravity. We shall succeed as we deserve. Let us learn to work intelligently, and to get the best results from our efforts.

ERRATA.

The following corrections are made in pages 115-116.

C. J. Bell,		
Expenses	$475 43	
Total,		$985 43
J. B. Harriott,		
Expenses	11 45	
Total,		$31 45
C. F. Smith, total		$161 50
Footing on page 116		$3121 51
Miscellaneous expenses, total		$220 00
Total expenses of board		$3341 51

EXPENSES OF THE BOARD OF AGRICULTURE.

From July 1, 1899, to July 1, 1900.

J. L. Hills,		
Services	$184 00	
Expenses	130 99	
		$314 99
J. K. Curtis,		
Services	264 00	
Expenses	212 16	
		476 16
C. J. Bell, Secretary.		
Services	510 00	
Expenses	474 84	
		984 84
Aaron Jones,		
Services	20 00	
Expenses included in C. J. Bell's account.		
		20 00
T. B. Terry,		
Services and expenses		100 20
J. H. Brigham,		
Services	42 00	
Expenses	8 00	
		50 00
C. W. Burkett,		
Services	24 00	
Expenses	21 15	
		45 15
C. A. Chapman,		
Services	12 00	
Expenses	8 87	
		20 87
John E. Gale,		
Services	24 00	
Expenses	18 07	
		42 07
John Gould,		
Services	180 00	
Expenses	85 83	
		265 83
Ernest E. Hitchcock,		
Services,	32 00	
Expenses	26 41	
		58 41
L. B. Harris,		
Services	20 00	
Expenses	25 53	
		45 53
T. B. Harriott,		
Services	20 00	
Expenses	10 45	
		30 45

L. R. Jones,		
Services	40 00	
Expenses	34 81	
		74 81
T. L. Kinney,		
Services	20 00	
Expenses	13 10	
		33 10
D. H. Morse,		
Services	92 00	
Expenses	62 61	
		154 61
Cassius Peck,		
Services	16 00	
Expenses	9 71	
		25 71
C. F. Smith,		
Services	96 00	
Expenses	65 50	
		161 57
Geo. H. Terrill,		
Services	80 00	
Expenses	60 57	
		140 57
J. W. Titcomb,		
Services	36 00	
Expenses	39 12	
		75 12
		$3099 92

MISCELLANEOUS EXPENSES.

Caledonian Co. Printing	113 26	
Free Press Association, printing and express	63 72	
The Tuttle Co., printing	26 25	
T. A. Thompson & Co., one acetylene generator and fixtures, half value	16 77	
		222 02
Total expenses of Board		$3321 94

REPORT OF THE BOARD OF AGRICULTURE AS CATTLE COMMISSIONERS.

From July 1st, 1899, to July 1st, 1900.

Regulations of Vermont Board of Agriculture acting as Cattle Commissioners relating to inspection and quarantine of cattle.

INSPECTION.

I. Owners of cattle in the state may have their herds tested with tuberculin at state expense by applying to the Board. Owners of herds tested by the state will notbe allowed to admit cattle into their herds unless such cattle have been tested or have come from herds tested by the state.

II. All cattle that are judged tuberculous on test made by the state, must be killed and the bodies burned or buried. Owners of herds are required to bear the expense of killing and disposing of the bodies. The hides of the cattle killed will be at the disposal of the owners.

III. Applications for tests will be complied with as far as practicable in order received. Exceptions to this rule are sometimes made for the purpose of testing herds suspected of being tuberculous and for completing tests in a given locality.

IV. Applications to test a portion of a herd only will always be refused.

V. The Board claims the right to re-test herds in which disease is found whenever they think best. A second test will not be made in herds where no disease or suspicious cases are found on the first test.

VI. No indemnity will be allowed for cattle killed by their owners and found diseased where no inspection has been made by the Board.

VII. Persons having herds tested, from which diseased animals are killed, will be required to observe the rules and directions of the Board in disinfecting their premises.

DISINFECTION OF STABLES.

Things required—Brooms, pails, hoe, barrel, spray pumps, and a half-pound of the following mixture for each five stalls: Corrosive Sublimate, Ammonium Chloride; equal parts well mixed.

Directions—Remove all live stock, and after sprinkling to lay the dust sweep all dust and dirt from mangers, walls and floors scraping loose gummy material clinging to mangers and stanchions with hoe. Mix well one package of disinfecting powder and thirty

gallons of water, then dip out in pails and with broom scrub mangers and stanchions, then with spray pump thoroughly drench ceiling, side walls floor, etc., using at least a barrel of solution to each five stalls.

Caution—This solution is poison, so do not leave pools of it in mangers.

QUARANTINE.

I. Under the quarantine regulations now in force, no cattle are allowed to enter Vermont from any source, to be held in the state without a permit from the Board. Any common carrier who leaves an animal in the state without being accompanied by such permit, or any person who brings an animal into the state without snch permit is liable to a fine not exceeding $200.

II. Permits will be issued to persons to bring cattle into the state after such cattle have passed an examination with tuberculine that is satisfactory to the Board. Such cattle will be held in quarantine at some place designated by the Board until identified and released.

Permits will also be given to persons to bring cattle into the state, and the same shall be held at snch place as shall be designated by the Board under quarautine restrictions until tested with tuberculin some person approved by the Board and judged to be free from tuburculosis.

III. All expenses iucurred in identifying, releasing and testing cattle under the preceding rule must be paid by the owner of the cattle.

IV. Applications for permits to bring cattle into the state should be made to the Secretary of the Board.

Adopted December 16, 1898.

It has seemed hard to some buyers of cattle and especially to farmers living on the borders of the State to be obliged to comply with these regulations.

To show the necessity of this I will state only one case. A man from another state, knowing our rules, led a suspicious cow to the state line in the night, a Vermont party there to purchase. This cow, in three months, changed owners four or five times, but fortunately was kept by herself with the exception of a few days when she was in one herd, where, upon a test three months later four were killed that no doubt contracted the disease while this cow was in the stable and the injury done cost the state over fifty dollars.

The commission have realized the necessity of a strict quarantine and have required a permit to enter cattle into the state, and upon arrival unless a satisfactory test previously made, the cattle to be tested by a veterinary acceptable

to the Commission before the animals were released from quarantine.

Some who have thought best to disregard this rule and have brought in one or more head without either the permit or test have been looked up by the Commission and asked to pay a small fine which has been turned over to the state treasury. This the Commission have done believing it to the best way for some individuals to remember the laws of the state. All cases coming to our knowledge have been looked after and our rules enforced. By this method many head of cattle that would have done injury to our herds have been kept out.

All the New England states except Connecticut have quarantine regulations, some as strict, but none more so than Vermont.

Several of the Middle and Western states have within the year made and are enforcing strict quarantine regulations of cattle brought to them from New England and New York.

The table will show the number found diseased and killed also those tested coming from without the state that were returned as soon as condemned.

We would call your attention to the re-tests showing that upon the second test the disease is generally stamped out if our rules for disinfection of stables is well observed.

Several complaints have come to the Commission from the selectmen of a town, director of a creamery or from some individuals when we have felt it our duty to look into the matter, and the Commission have in all cases prevailed upon the owner to have the questionable herd tested, and in nearly all cases found the disease, sometimes to an alarming extent.

The Commission arranged with the owner of one large herd to have the tuberculin test applied. The owner perhaps knowing the disease to be there to a considerable extent, although working in every way to rid his herd of the disease, except to have the tuberculin test used, had in the past four years labored in vain for seventy-eight of the ninety-two head were slaughtered and found diseased. Upon a re-test six more were taken leaving only eight of the herd.

These cattle were kept in a light and well ventilated stable and with but a very few exceptions, to the inexperienced eye would be considered healthy. They were in fine condition, many of them good beef, yet upon slaughtering, four-fifths of them were diseased all through.

The Commission were informed after the slaughter that the owner had in the past four years quietly buried nearly as many as were killed in order to keep his herd looking healthy.

Another herd into which many cattle were imported from time to time, the Commission persuaded the owner to have

tested. This herd numbered considerably over one hundred head. Among the young cattle we found only one to condemn. The cows were nearly three-fourths diseased. The Commission arranged with the owners to quarantine the herd and sell the product out of the state—to the same parties to whom it had been sold for several years—killing many of the most pronounced cases. Some have been slaughtered on a second visit and the work will be continued until all the diseased ones are stamped out, which will be before many months.

Meanwhile these cows are on a farm by themselves away from all healthy cattle. This arrangement was made by the Commission upon condition that the state pay no indemnity for slaughtered cattle.

Many instances could be cited where the cattle owner thought to do better than to use the tuberculin test, but in every case sooner or later, the fates are against him and in some quiet spot on the farm the graves can be counted in numbers which shows the herd did not increase even by raising all the calves. The income of the average farmer will not long allow him to continue the business of dairying unless he avails himself of the privileges the state offers him.

The per cent of diseased cattle is greater this year than former years. This is occasioned by testing only where there was a suspicion of disease and more particularly mentioned herds.

The tuberculin test may be relied upon only in experienced hands. Some badly diseased animals will not show a reaction by the injection of so small an amount of tuberculin but the experienced eye will almost always detect other symptoms afterthe injection.

The Commission require the Veterinaries that are employed by the state to inform them of any private tests made that the sale of diseased cattle may be hindered.

Where a test of this kind had been made, eighteen head showed a reaction. The owners were called upon by the Commission who offered to take them and slaughter in behalf of the state, but were declined the owners themselves, preferring to dispose of them. After several weeks of delay the cattle were driven to an adjoining town, said to have been sold and were going out of the state. The Commission quarantined them and slaughtered without paying any indemnity.

Permits to bring cattle in to pasture without a test and usually without examination have been given to parties in New York, New Hampshire and on the borders of Massachusetts. But cows coming from the market in Massachusetts for

pasture, a test has been required this year, for last season upon test of one car load 12 were returned. Two cows that were slaughtered out of one herd last January were found to have been purchased of a Massachusetts man who had cattle here to pasture last season. The Commission did not find the man but a relative was found in Vermont who saw fit to pay one-half the appraised value of the cows which was paid over to the owner of the herd.

More than one thousand head came in to pasture and will be returned at the close of the pasture season. Permits other than pasture permits have been issued for nearly seventeen hundred head to come into the state. All these have been tested except young calves and these we require to come, as much as possible, from healthy herds.

In the opinion of the Commission Vermont is gaining in reputation as a state for healthy cattle and in many of the towns where all the cattle have been raised tuberculosis does does not exist unless brought in by the purchase of some improved stock.

Some of the larger towns and cities would do well to require of the milk men that their herds be tested for there are some localities in Vermont where there is reason to believe tuberculosis exists to some extent. There are some towns that could be named where cattle buyers cease to go to purchase cattle after the first visit.

The belief of some that no disease exists among cattle and by others who possibly may have suspicion, but do not wish to know the fact, aids very much in keeping cattle in circulation in different parts of the state and does not lesson the distribution of the germs of disease.

SHEEP.

A disease has prevailed to some extent in Caledonia county, brought there, perhaps, by importing some flocks. The Bureau of Animal Industry of the Department of Agriculture, Washington, D. C., tells us it is pronounced "*Oesophazostoma Columbianum*," better known as the Nodular disease and more familiar in the flocks in the state of Virginia. This disease shows itself mostly in the intestines and lungs, and the Department informs us that the mutton is not injured for consumption so that in order to exterminate the disease which appears in all the flocks "so far as we have investigated" those fit for market at any price are sent and the remainder buried. In one small flock none were fit for mutton and in all the flocks many had died previous to our coming where the disease was well established. But few lambs live through the first winter. No remedy for this disease is known to us.

HORSES.

Six glandered horses have been slaughtered.

Following are tables showing the number of cattle that have been tested, the number killed and the amount paid for deceased animals. The expenses of the Board of Agriculture, the expenses of the Cattle Commission, the total number of cattle tested in the state since the present law was made in 1894, the number killed and the amount paid for them.

C. J. BELL, Secretary.

EXPENSES OF CATTLE COMMISSIONERS.

MEMBERS OF COMMISSION.

J. L. Hills,		
Services	$ 20 00	
Expenses	7 58	
		$ 27 58
J. K. Curtis,		
Services	138 00	
Expenses	96 87	
		234 87
C. J. Bell,		
Services	540 00	
Expenses	479 78	
		1019 78
Total expenses of Members of Commission		$1282 23

VETERINARIANS.

W. L. Adams,		
Services	172 50	
Expenses	23 24	
		195 74
H. Buss,		
Services	130 50	
Expenses	9 33	
		139 83
H. W. Burgess,		
Services	2 00	
Expenses	2 00	
		4 00
J. S. Dutton,		
Services	92 00	
Expenses	26 53	
		118 53
B. M. Flint		
Services	18 00	
		18 00
C. W. Fisher,		
Services	15 00	
Expenses	2 94	
		17 94
A. B. Gay,		
Services	14 00	
		14 00

A. W. Gosham		
Services	5 00	
		5 00
Hiram Philipson,		
Services	20 00	
Expenses	5 92	
		25 92
W. T. Pike,		
Services	6 00	
		6 00
I. W. Parks,		
Services	12 00	
Expenses	3 90	
		15 90
Rich & Fisher,		
Services	20 00	
Expenses	4 13	
		24 13
F. A. Rich,		
Services	261 50	
Expenses	62 45	
		323 95
Geo. Stephens,		
Services	131 50	
Expenses	16 11	
		147 61
John Thomas,		
Services,	178 50	
Expenses	29 15	
		204 65
Geo. W. Ward,		
Services	10 00	
Ezpenses	5 50	
		15 50
Total Expenses of Veterinarians		$1276 70
The Tuttle Co. Printing and binding permits		26 85
Total expenses of Cattle Commission		$2585 78

SUMMARY OF WORK OF THE COMMISSION.

Tested in Herds	3617
Tested for drovers and on permit	2254
Total cattle tested	5871
Number cattle killed from herds	328
Number cattle killed from droves	2
Total cattle killed	330

Paid for cattle killed in herds	$4748 75	
Paid for cattle killed from droves	12 00	
Total paid for cattle,		$4760 75
Paid for six glandered horses		82 00
Paid for 48 sheep		57 00
Total paid for diseased animals		$4899 75
Total paid members of Commission		1282 23

Total paid Veterinarians	1276 70
Total paid Tuttle & Co.	26 85

Total expense of the Cattle Commisson and cattle killed $7485 53

C. J. BELL, Secretary.

Number of cattle tested under the laws of 1894.

All cattle tested	72,893
All cattle killed	2,903
Total amount paid for cattle killed	$36,902 25

CATTLE TESTED.

Date.		Name. P. O.	No. Tested.	No. Killed	Am't of Order.
1899.					
Aug.	10 H*	W. A. Farnham, So. Royalton	57		
Aug.	10	Farnham & Noyes, "	12	10 returned	
Aug.	3 H	L. F. Baird, Sheldon Springs	1	1	$5.00
Aug.	9 H	I. W. Gray, East Calais	10		
July	31 H	H. H. Long, Middlesex,	15	2	30.00
Apr.	29	C. D. Nottbeck, Dorset	1		
Aug.	17	L. W. Doe, Bradford	1		
July	10	R. S. Davis, Williamstown	1		
July	10	C. H. Bigelow, E. Brookfield	1		
July	10 H	Peter Golden, Wolcott	2		
July	10 H	A. E. Foot, "	1		
July	10 H	C. E. Clark, "	1		
July	10 H	C. E. Sleeper, "	1		
July	10 H	R. M. Hubbell, "	1		
July	10 H	E. C. Mann, "	1		
July	10 H	J. W. Scott, "	2		
July	10 H	Elias Richardson "	1		
July	10 H	Newell Woodward, Wolcott	1		
July	10 H	Chas. O. Morse, "	1		
July	29 H	Dr. Rublee, Morrisville	1		
Aug.	16 H	Geo. Wilkins, Stowe	23	5	66.00
Feb.	28	L. C. Spaulding & Son, Poultney	5		
May	6	A. A. Pond, Brandon	6		
July	22	A. A. Pond, "	1		
July	29	A. A. Pond, "	5		
July	23	——— French, "	2		
July	29	——— " "	5		
Aug.	5	A. A. Pond, "	3		
Aug.	12	A. A. Pond, "	9		
Aug.	26	——— French, "	4		
Aug.	20	Geo. Cary, St. Johnsbury	8		
May	11 H	H. D. Webster, East Burke	1		

* H signifies herd. The others droves or permits.

May	11	H	W. J. Counter " "	1		
Sept.	12		Alvin Mayette, Fairlee	1		
Sept.	3	H	Clarence Ingram, Brattleboro	9	4	67.50
Aug.	21	H	Henry Fitts, Randolph	7		
Aug.	17	H	G. S. Moulton, "	8		
Aug.	15	H	J. J. Pratt, Braintree	8		
July	16	H	H. Fairbanks, St. Johnsbury	3		
July	16	H	Horace Peck, "	2		
Aug.	31	H	Alvin Mayette, Fairlee, re-test	1	1	12.50
Sept.	10	H	J. T. Maynard, Westminster	13	2	30.00
Sept.	19	H	E. E. Bancroft, Montpelier	21	8	160.00
Sept.	18	H	Noyes White, Brattleboro	1	1	17.50
June	10		M. S. Carr, Middlebury	13		
July	15		" "	15		
Aug.	12		" "	10		
Sept.	12		" "	18		
Sept.	16		" "	9		
June	11		D. O. Noonan, Vergennes	6		
June	17		" "	8		
Aug.	6		" "	6		
Aug.	19		" "	8		
June	17		J. J. Quinlan, North Ferrisburg	9		
June	24		" " "	28		
July	22		" " "	23		
Aug.	31	H	Ed. Blake, Newport	15		
Aug.	31	H	D. E. Stevens, West Derby	1		
Aug.	31	H	W. E. Robinson, W. Derby Line	1		
Aug.	15	H	E. Richards, Newport	1		
Aug.	23		A. J. Gee, "	6		
Sept.	23		J. J. Quinlan, N. Ferrisburgh	27	3 returned	
Sept.	26		G. H. Root, Hortonville	27		
Sept.	9		W. A. Ricker, St. Johnsbury	21		
Sept.	23		" "	14		
Oct.	8		" "	15		
Gct.	6	H	Fred Fowl, Townshend	1		
Oct.	9		H. E. Minoe, Brattleboro	3		
Sept.	2		Charles Delong, Cornwall	46		
Sept.	11		Farnham & Baldwin, Shoreham	40		
Oct.	7		——— Farnham "	27		
Oct.	20		Barnes Bros., Brattleboro	24	4 returned	
Oct.	17	H	Village Cows, Wilmington	5		
Oct.	14		J. J. Quinlan, N. Ferrisburgh	28	2 returned	
Oct.	7		M. S. Carr, Middlebury	9		
Oct.	26		A. P. Needham, Vergennes	12		
Oct.	25		M. E. Hewitt, Bristol	20		
July	30		D. O. Noonan, Vergennes	9		
Oct.	29	H	Elliott Jennison, Townshend	2	2	32.50

Oct.	29 H	Robert Holbrook, Townshend,	1	1	19.00
Sept.	14 H	J. J. Dodge, Dummerston	4		
Oct.	7 H	Experiment Station, Burlington	56		
Oct.	7 H	H. B. Chittenden "	7		
Oct.	26	Russell Briggs, Brattleboro	2		
Oct.	28	B. M. Ricker, Groton	2		
Nov.	10 H	Scott H. Richmond, Hale	1	1	15.00
Oct.	13 H	A. B. and B. A. Stockwell, Middlesex	17	1	12.50
Nov.	11 H	L. C. Fisher, Cabot, re-test	46		
Sept.	14 H	James Barrett, S. Clarendon	2		
Sept.	25 H	Jessie Billings, Rutland	5		
Nov.	4 H	S. R. Kendall "	6		
Oct.	30	L. C. Woodruff, Brownsville	5		
Nov.	7	R. N. Donahue, Fairlee	1		
Nov.		E. H. Whitcher, Albany	1		
Oct.	7	H. A. Pond, Brandon	10		
Sept.	11	C. M. Winslow, "	22		
Aug.	28	" "	11		
Aug.	24	Mrs. M. M. Patterson, Rutland	14		
Nov.	17 H	W. A. Smith, N. Thetford	2		
Nov.	20	L. R. Brown, Burlington	22		
Nov.	29 H	Wm. E. Dutton, Hartford	36	1	15.00
Sept.	23	T. Gallagher, Craftsbury	59		
June	15	" "	26		
Oct.	17 H	Geo. Wilkins, Stowe, re-test	28	5	51.50
Nov.	16 H	W. W. Peck, Morrisville, re-test	6	2	22.50
Oct.	21	T. Gallagher, Craftsbury	51		
Nov.	17 H	L. D. Grout, Morrisville	12		
Oct.	4 H	T. A. Waterman, Johnson	10		
Aug.	28 H	Lewis Chartle, Wolcott	2		
Aug.	28 H	M. J. Leach, "	7		
Aug.	28 H	C. E. Taylor, "	1		
Aug.	28 H	C. A. Hasker, "	1		
Oct.	29	B. M. Ricker, Groton	2	2	12.00
Nov.	13 H	Chas. Johnson, Vernon	35	12	187.50
Nov.	8 H	Albert Hall, Ryegate	28		
Nov.	27 H	Wm. B. McElroy. Middlesex	1	1	30.00
Nov.	18 H	A. R. Johnson, Moretown	13		
Nov.	12	Frank S. Atwood, Woodstock	10		
Nov.	22 H	A. E. Mann, Windsor	10		
Nov.	6 H	Frank P. Wells, Bartonsville	29		
Nov.	24 H	F. O. Newcomb, Union Village	9		
Nov.		Barnes Bros., Brattleboro	19	2 returned	
Nov.	1 H	L. A. Gibbs, White River Jct.	1		
Nov.	2 H	N. T. Dunbar, North Hartland	10		
Nov.		A. L. Haskell, Roxbury	23		

June 29	Fred Spaulding, W. Brattleboro	1		
Oct. 6 H	Geo. L. Witherwell, Bartonsville	58	15	209.00
Aug. 12	Frank W. Dawmore, Hartford	1		
Sept. 12	John P. Jewett, Barnard	6		
Oct. 30 H	Charles Bugbee, Hartford	1		
Nov. 21 H	Geo. A. Bailey, South Ryegate	1		
Nov. 16	W. J. Roy, Barnet	20		
Nov. 29	Elisha Flowers, Rupert	1		
Nov. 25	W. W. Pitkin, Plainfield	27		
Nov. 26	Frank Ricker, Groton	3		
Nou. 22	Alex Greer, Newbury	4		
Nov. 10	W. Thompson, Ryegate	9		
Nov. 29	M. J. Carrigan, Chester	25		
Oct. 12	L. N. Collier, Derby	1		
Oct. 17	David McKay, St. Johnsbury	1		
Oct. 20	W. A. Ricker, "	9		
Oct. 21	C. A. Ramsdell, North Troy	4		
Oct. 27	R. W. Foss, Newport	26		
Nov. 6	Ed. Blake, "	19		
Nov. 2	L. S. Dudley, Randolph	5		
Oct. 18 H	G. L. Witherwell, Bartonsville re-test	13	2	21.00
Nov. 22	A. E. Mann, W. R. Junction	4		
Nov. 30	Geo. W. Brown, Bradford	3		
Nov. 30	Geo. W. Smith, W. R. Junction	1		
June 27	Herbert Snow, Fairlee	2		
Nov. 11	J. J. Quinlan, N. Ferrisburg	32		
Nov. 5	" "	29		
Apr. 3	C. de Nottbeck, Dorset	7		
Dec. 1	A. L. Haskell, Waitsfield	26		
Dec. 2	B. M. Ricker, Groton	4		
Dec. 2	W. Thompson, Ryegate	8		
Dec. 4 H	A. B. Greenwood, Townshend	23	1	5.00
Dec. 2	C. E. Stanley, Washington	21		
Dec. 6 H	E. C. Bond, Thetford Hill	20		
Dec. 12	W. E. Camp, Pompanoosuc	1		
Dec. 7 H	E. L. Perkins, Johnson	8		
Dec. 7 H	C. G. Buttin, "	6		
Dec. 11 H	Will Peck, Morrisville	27		
Dec. 15 H	A. Boubrissse, E. Burke	9		
Dec. 11 H	H. Walter, West Burke	1		
Dec. 11 H	E. E. Alexander, W. Burke	1		
Dec. 11 H	J. W. Thompson, St. Johnsbury	1		
Dec. 11 H	O. C. Spencer, W. Burke	1		
Dec. 11 H	N. S. Colby, "	3		
Dec. 11 H	W. A. Drown, "	2		
Dec. 11 H	J. M. Dean, "	1		

Dec. 14 H	N. L. Parker & Son, E. Burke, re-test	31		
Dec. 11	O. Peltier, Brattleboro	6	2 returned	
Dec. 8	Barnes Bros., "	14	3 returned	
Dec. 15 H	David Lumsden, So. Ryegate,	38	14	300.00
Dec. 11 H	W. Kelsey, Waitsfield.	21		
Dec. 5 H	E. J. Harrington, Highgate Springs,	31	10	170.50
Dec. 7 H	Henry Holt, Burlington,	49		
Dec. 10	J. J. Quinlan, No. Ferrisburgh,	39	3 returned	
Dec. 12 H	Marvin Clark, Richmond, retest	127		
Dec. 23 H	Lewis Billings, Wolcott,	12	2	25.00
Dec. 11 H	M. H. Gibson, East Ryegate,	58	12	247.50
Dec. 24	W. M. Ware, E. Putney,	10		
Dec. 17	" "	16		
Dec. 16	H. G. Clark, Brattleboro,	7		
Dec. 2	W. M. Ware, E. Putney,	14		
Dec. 9	H. G. Clark, Brattleboro,	8		
Dec. 14	W. M. Ware, E. Putney,	14		
Dec. 10	Ernest Beebe, West Rupert,	1		
Dec. 27 H	E. M. Phifield, Ryegate,	18	1	17.50
Dec. 21 H	W. T. McLam, "	5		
Dec. 21 H	G. E. Meader, "	10		
Dec. 22 H	A. Buchanan, So. Ryegate,	17		
Dec. 4 H	G. Hall, Passumpsic,	1	1	15.00
Dec. 30	C. S. Rodgers, South Fairlee	1		
1900.				
Jan. 2 H	Luther Dustin, Brattleboro,	25	1	19.00
Jan. 3 H	Chas. Manchester, McIndoes Falls	1		
Jan. 3 H	W. J. Roy, Barnet,	18		
Jan. 2 H	Witherill Bros., Bartonsville, re-test,	43	2	21.00
1899.				
Dec. 19 H	Leon Bailey, Morrisville,	12		
Dec. 31 H	M. L Emery, Eden,	22		
Dec. 30	T. Gallagher, Craftsbury,	19		
1900.				
Jan. 4 H	Harrison Grout, Hyde Park,	2		
Jan. 4 H	Vernon Fitch, Hyde Park	10		
Jan. 4 H	Seth Farnham, Shoreham	20		
Jan. 11 H	Geo. Cochran, Ryegate	66		
Jan. 16 H	Clement Smith, Morrisville, re-test	56	1	40.00
Jan. 16 H	J. B. Ladeau, "	8		
Jan. 12 H	A. A. Royce, Stowe	12		
Jan. 13	T. Gallagher, Craftsbury	13		
Jan. 6 H	John Armstrong, Norwich	5		

Jan. 16 H	H. H. Long, Middlesex, re-test	12	1	5.00
Jan. 15 H	Fred M. Snow, N. Montpelier,			
	re-test	14		
1899				
Dec. 19 H	Frank Delong, W. Cornwall	12	1	9.00
Dec. 22	F. G. Holmes, Fairlee	1		
1900				
Jan. 13	H. G. Clark, Brattleboro	6		
Jan. 14	W. M. Ware, E. Putney	7		
Jan. 7	" "	13		
Jan. 6	H. G. Clark, Brattleboro	3		
1899				
Dec. 25	Frank Wood, E. Concord	1		
Dec. 31	W. M. Ware, E. Putney	13		
1900				
Jan. 31 H	Byron Stickney & Son, Saxtons			
	River	10	1	19.00
Feb. 1 H	G. G. Nelson, Ryegate	74		
Jan. 24 H	S. O. Sargent, Norwich	15	4	57.50
Jan. 10 H	Henry L. Porter, Johnson	10	6	97.50
Jan. 10 H	W. W. Patten, "	11		
Jan. 29 H	Joseph Perkins, West Rupert	3		
Jan. 17 H	James W. Brown, Norwich	1		
Feb. 13	Jefferson Welch, E. Burke, 36			
	sheep, Oesphayostoma			
	Columbianum			45.00
Feb. 13 H	N. H. Ricker, Ryegate	21		
Feb. 8	W. W. Brock, So. Newbury	1		
1899				
Dec. 29 H	J. Welch, E. Burke	25		
1900.				
Feb. 7	Adin Hewey, Springfield, 1 horse			
	glanders,			15.00
Jan. 23 H	M. H. Gibson, E. Ryegate, re-test	39	1	20.00
Feb. 21 H	F. L. Davis, North Pomfret			
	re-test,	28		
Feb. 21 H	H. W. Vail, North Pomfret,			
	re-test,	24		
Feb. 21 H	Chas. Carbee, Wells River,	12		
Feb. 19 H	M. H. Gibson, E. Ryegate re-test,	2		
Feb. 21 H	Chas. Bolkum, Wells River,	6		
Feb. 21 H	E. L. Carbee, "	2		
Feb. 12	W. M. Ware, East Putney,	19		
Feb. 11	H. G. Clark, Brattleboro,	6		
Feb. 4	W. M. Ware, East Putney	7		
Feb. 18	" "	7		
Feb. 23 H	C. H. North, Barre	8		

1899				
Dec. 19	C. M. Winslow, Brandon	21		
1900				
Feb. 11 H	C. Johnson, Vernon, re-test	36	6	98.50
Mar. 6 H	Geo. Cary, St. Johnsbury	39		
Mar. 1 H	Chas. L. Bugbee, Hartford, re-test	1	1	16.00
Mar. 7 H	D. S. Willard, North Hartland, re-test	25		
Mar. 7 H	H. J. Miller, "	1		
Mar. 8 H	E. O. Wheeler, South Pomfret	1	1	20.00
Feb. 21 H	R. W. Moodie, No. Wolcott	20	2	25.00
Feb. 4	W. M. Ware, East Putney	15		
Jan. 28	" "	9		
Jan. 27	H. G. Clark, Brattleboro	2		
Feb. 3	" "	2		
Jan. 21	W. M. Ware, East Putney	11		
Jan. 13	A. Williamson, Brandon	2		
Jan. 27	" "	1		
Feb. 25	" "	5		
1899				
Oct. 14	A. A. Pond, Brandon	4		
Oct. 28	" "	3		
1900				
Feb. 24	" "	2		
Feb. 28	Geo. Cary, St. Johnsbury	1		
Mar. 17 H	D. B. Neal, W. R. Junction, re-test	49	1	17.50
Mar. 21 H	P. W. Strong, North Pomfret re-test	21		
Mar. 14 H	N. H. Ricker, Ryegate	44		
Mar. 17	Thompson & Nelson, Ryegate	5		
Mar. 13 H	M. Goslant, Lanesboro	7		
Mar. 9 H	L. J. Huntley, Algiers	16	4	65.00
Jan. 27	M. S. Carr, Middlebury	10		
Jan. 13	" "	11		
Jan. 27	D. O. Noonan, Vergennes	6		
Feb. 24	" "	9		
Jan. 13	" "	6		
Jan. 13	J. J. Quinlan, No. Ferrisburg	3		
Jan. 13	" "	19		
Jan. 28	" "	34		
Mar. 4	" "	16		
Mar. 11	D. O. Noonan, Vergennes	11		
1899				
Dec. 3	J. J. Quinlan, No. Ferrisburg	26		

1900				
Mar. 11	M. S. Carr, Middlebury	9		
Mar. 17	W. A. Ricker, St. Johnsbury	5		
Mar. 16	David Pierce, Sharon	1		
Mar. 16	Elmer Sykes, W. R. Junction	2		
Apr. 5	Mitchell Goslant, Lanesboro, 3 horses, glanders,			35.00
Mar. 14 H	C. W. Emerson, Charlotte	9		
Mar. 24	Geo. Miller, Algiers	3		
Jan. 30 H	John R. Hill, Johnson, re-test	11	1	17.50
Jan. 10 H	——— Buck, Johnson, re-test	3		
Apr. 3 H	F. M. Weld, Groton	21		
Mar. 21 H	M. H. Gibson, East Ryegate, re-test	20		
Mar. 30	Wm. J. Armstrong, Norwich	6		
Apr. 2 H	J. H. Loveland, "	39		
Apr. 3 H	L. S. Matthews, "	35		
Apr. 3 H	S. A. Johnson, "	12		
Mar. 29 H	L. F. Sheldon, Rupert	7		
Mar. 21 H	A. R. Bennett, Barton Landing	3		
Mar. 21 H	W. C. Twombly, "	2		
Mar. 26 H	J. S. Knowlton, Bellows Falls, re-test	15		
Mar. 10	A. A. Pond, Brandon	3		
Mar. 29 H	Max Tankle, Fairlee	2		
Mar. 27 H	Dr. H. H. Read, Shelburne	19		
Mar. 24	H. G. Clark, Brattleboro	7		
Mar. 31	" "	4		
Apr. 1	W. A. Ricker, St. Johnsbury	10		
Mar. 17	J. J. Quinlan, No. Ferrisburgh	21		
Mar. 25	D. O. Noonan, Vergennes	11		
Mar. 25	M. S. Carr, Middlebury	11		
Mar. 25	John Cook, Putney	19		
Apr. 10 H	R. A. Dixon, No. Shaftsbury	1	1	7.50
Apr. 15	D. O. Noonan, Vergennes	7		
Apr. 8	" "	11		
Apr. 8	M. S. Carr, Middlebury	12		
Mar. 30	J. J. Quinlan, No. Ferrisburgh	20		
Mar. 30 H	E. W. Foster, E. Swanton	31	2	30.00
Mar. 29 H	E. J. Harrington, Highgate Springs, re-test	30	7	94.00
Apr. 11 H	E. A. Emery, Woodstock	10		
Apr. 5 H	Joe Thompson, St. Johnsbury,	1	1	17.50
Apr. 8 H	Ed. Pierce, Groton,	4		
Apr.	Frank Ricker, Groton.	3		
Apr. 4 H	H. A. Nelson, Groton,	50	2	35.00

Feb. 15 H	Chas Dole, Northfield,	7	2	not in state 6 months.
Feb. 15 H	R. H. Farr, "	2		
Feb. 4 H	Dr. G. W. Hoffman, White River Junction,	2		
Apr. 11 H	C. A. Gale, Montpelier,	20		
Apr. 11 H	Norman McLeary Graniteville,	3		
Apr. 5 H	M. J. Leach, Fletcher,	4		
Apr. 5 H	J. H. Ware, Townshend,	1	1	19.00
Apr. 22 H	F. D. Reed, Townshend,	5	3	51.50
Mar. 22 H	Speedwell Farms, Lyndon Center,	92	78	1237.50
Apr. 25	R. M. Chamberlin, So Newbury,	1		
Apr.	Geo Cary, St. Johnsbury,	12	1 returned	
Apr. 2	Roeder and Keene, Derby Line,	24	2 returned	
May 1 H	E. L. Eastman, Passumpsic, retest,	60	1	15.00
May 24	A. E. Waite, Orwell,	8		
May 29 H	——— Dundon,	1		
May 30 H	Mrs. Martha Hazard, St. Albans,	17	13	190.00
May 30 H	David Moore, Sheldon, Springs,	10	1	17.50
May 31 H	E. W. Jewett, Swanton,	19		
May 25 H	Fred Lawrence, Morrisville,	40		
May 3	W. E. Fitts, Corinth,	12		
May 15	H. F. Graham, Craftsbury,	2		
Apr. 20 H	Geo. Holmes, St. Johnsbury,	1		
May 12 H	Geo. M. Gray, St. Johnsbury,	1		
May 19 H	Lona Grow, Brownington Ctr..	1		
May 16 H	Moulton Bros, Randolph,	133	8	no indem
May 20	H. G. Clark, Brattleboro,	4		
May 11	Frank Bushee, Canaan,	1	Private test	
May 20 H	H. A. Putnam, Morrisville,	1		
May 17 H	Horace Baxter, Swanton,	1	1	20.00
May 17 H	N. E. Chamberlain, Swanton,	1	1	20.00
May 17 H	W. H. Collins, Swanton,	1		
June 9 H	C. A. Keazer, Corinth,	1	1	7.50
June 7 H	Exlow Bishop, Hartland Four Corners,	1	1	no indem.
1899				
Dec. 4 H	Horace F. Graham, Craftsbury,	1		
1900				
May 17	Chas. Hosford, Wells River,	1		
May 17 H	John Bailey, Wells River,	1		
May 11	Geo. W. Dow, Wells River,	3		
May 22 H	F. M. Weld, Groton, retest,	1		
May 24 H	Geo. Wiley, Rockingham,	4	2	35.00
May 23 H	Charles Johnson, Vernon,	4		
May 20 H	Gilbert Harper, South Burlington,	1	1	10.00
May 18 H	C. C. Sheldon, East Highgate,	44		
May 15 H	Industrial School, Vergennes,	11		

May 27	D. O. Noonan, No. Ferrisburg,	7		
May 27	A. Williamson, Middlebury,	8		
May 20	N. H. Woodard, Whiting,	10		
May 13	M. S. Carr, Middlebury,	10		
May 7 H	D. C. Barber, Burlington,	42	1	12.50
Apr. 21	J. J. Quinlan, No. Ferrisburg,	14		
Apr. 26 H	Waterbury State Asylum,	18		
Apr. 2 H	Geo. Williams, So. Burlington,	7		
Apr. 27 H	J. E. Green, Waterbury,	33		
Apr. 24 H	G. W. Randall, Waterbury,	24		
May 12	M. E. Green, Waterbury,	20		
Apr. 14 H	G. W. Randall, Waterbury,	120	18	289.25
June 4	Geo. Bush, Orwell,	3		
June 6	Chas. Rice, Castleton,	1		
June 25	Silas E. Holloway, Greensboro Bend,	1 horse, glanders' no indem.		
May 10 H	A. E. Willard, Burlington,	9	1	15.00
May 10 H	——— Van Patten, Burlington,	1		
May 12	Geo. Williams, Burlington,	7		
Apr. 17 H	Mary Fletcher Hospital, Burlington,	32	19 no indem.	
May 12	Mary Fletcher Hospital, Burlington,	10		
May 26	J. J. Quinlan, No. Ferrisburgh,	15		
June 23	J. W. Beumond, Bellows Falls,	2		
June 23	M. M. Whitney, Bellows Falls,	1		
June 18 H	H. W. Howard, Bellows Falls,	13		
June 18 H	M. H. Dickinson, Corinth,	13		
June 19 H	Abraham Jacobs, South Corinth,	5		
June 15 H	Geo. H. Savage, West Hartford, retest,	22		
May 14	E. B. Hurd, Sandgate,	2		
June 3 H	Frank Perry, Canaan,	7		
May 26 H	E. F. Cushion, Canaan,	1		
June 11 H	H. E. Bowman, Pittsfield,	1		
June 11 H	Frank Durkee, Pittsfield,	1		
June 11 H	Albert Vose, Pittsfield,	1		
June 11 H	Geo. Chedle, Pittsfield,	1		
June 11 H	Stedman Stoddard, Pittsfield,	4		
June 9	Geo. M. Adams, St. Johnsbury,	10		
May 24 H	D. W. Roberts, No. Pomfret,	23		
June 14 H	Kelso B. Clark, Hartford, retest,	16		
June 14 H	Geo. Fuller, Hartford,	1		
May 28	A. M. Fletcher, Proctorsville,	8		
May 28	R. J. Goss, Hartford,	1		
Apr. 26 H	Y. D. Nelson, Ryegate	39		
May 10 H	J. D. Odell, Johnson	1		

May 10 H	W. M. Tracy, "	1		
May 10 H	H. B. Tupper "	1		
May 10 H	T. J. Baker, "	1		
May 10 H	W. H. Nye, "	1		
May 10 H	E. E. Holmes "	7		
Apr. 30 H	H. B. Palmer, "	25		
Apr. 27 H	D. Lumsden, So. Ryegate, retest	33		
Apr. 30 H	N. Bigelow, Stowe,	24		
Apr. 24 H	Geo. E. Smith, No. Hyde Park,	1		
Mch 21 H	J. J. Anais, Hardwick,	1		
May 14	H. G. Clark, Brattleboro	4		
May 11	Barnes Bros, "	16		
May 10	Eugene H. Akley, Vernon	4		
May 10 H	I. E. Bond, Union Village	10		
Apr. 27	H. G. Clark Brattleboro	10		
Apr. 27	Timothy Boyle, Hartland Four Corners	13		
Apr. 20 H	Geo. Cochrane, Ryegate	1	1	20.00
May 5	M. S. Carr, Middlebury	26		
June 6 H	Jonas Stearns, Waterbury	9	6	87.50
June 5 H	B. W. Shaw, "	21	4	60.00
June 10	N. H. Woodward, Whiting	.15		
June 10	M. S. Carr, Middlebury,	8		
May 27	D. O. Noonan, Vergennes,	7		
May 31	Ayres and Brown, Essex Center	10		
June 3	N. H. Woodward, Whiting	9		
June 29	E. L. Brown, Topsham	13	1 returned	
June 21 H	J. H. Barney, Swanton	9		
June 21 H	W. O. Smith, "	1		
June 21 H	Horace Baxter, "	1		
June 21 H	E. M. Prouty, "	2		
June 21 H	A. F. Curtis, "	1		
June 21 H	Lewis Noley, "	1		
June 21 H	Richard Cohunt, "	1		
June 24	A. Farnham, Shoreham	33		
June	A. P. Needham, Leicester Jct., 1 horse, glanders			32.00
May 21	D. W. Frances,	24		
May 15 H	R. R. Lawrence, Wilder	2		
May 18 H	H. H. Leland, Barton Landing	19	1	12.50
May 18	H. H. Leland, Barton Landing 12 sheep killed			12.00
May 15	M. S. Carr, Middlebury	28		
May 10	M. H. Gibson, East Ryegate,	19		
May 9	B. M. Ricker, Groton,	15	4 returned	
Apr. 11 H	D. S. Luce, Waterbury,	1	1	15.00
May 26	Frank Sheldon, West Rupert	1		

June 28	L. B. Loveland, Rupert	1		
June 26 H	N. J. Batchelder, Greensboro	11		
June 30 H	A. W. Daniels, St. Johnsbury	15	7	100.00
June 17	N. H. Woodward, Whiting	8		
June 24	" "	10		
June 24	A. W. Williams, Middlebury	7		
June 25	D. O. Noonan, Vergennes	8		
May 26	L. R. Brown, Burlington	41		
Jan. 1	Geo. W. Hill, Wilder	1		
June 9	D. G. Wheeler, Pawlet	11		

REPORT

OF THE

THIRTIETH ANNUAL MEETING

OF THE

VERMONT DAIRYMEN'S ASSOCIATION.

1900.

EDITED BY

F. L. DAVIS, SECRETARY.

BRADFORD, VT.
Press of Opinion Publishing Company,
1900.

An Act to Promote the Dairy Interests of Vermont.

It is hereby enacted by the General Assembly of the State of Vermont:

SECTION 1. The sum of one thousand dollars is hereby appropriated annually to the Vermont Dairymen's Association, for the purpose of promoting, developing and encouraging the dairy interests of this State.

The Auditor of Accounts is hereby directed to draw an order on the State Treasurer in favor of the Treasurer of the Vermont Dairymen's Association, for the first payment of this appropriation on the first day of January, A. D., 1889, and annually thereafter so long as the conditions hereinafter provided shall be complied with.

SEC. 2. Said Vermont Dairymen's Association shall hold an annual meeting, continuing for at least three days, at some town or city in this State of easy access to the people, and in some comfortable and convenient building; and said meeting shall be open and free to the people of the State. At said meeting the best available talent in the country shall be employed to teach and discuss the best methods of dairy farming, and subjects connected therewith; and at the said annual meeting, premiums shall be offered for the best dairy products of butter and cheese, to an amount of at least two hundred dollars; such premiums to be awarded by disinterested and expert judges, and paid by the treasurer of said Vermont Dairymen's Association.

SEC. 4. The Secretary of said Vermont Dairymen's Association, shall, on or before December 1, 1889, and annually thereafter, make a detailed and itemized account to the State Auditor of Accounts of the receipts and expenses of said Association, which accounts shall be approved and countersigned by the Treasurer and Auditor of said Association.

SEC. 5. If, in any year, it shall appear to the State Auditor of Accounts that any part of the preceding annual appropriation remains unexpended, or has not been honestly or judiciously expended, then such a part or amount shall be deducted from the order for the next succeeding annual appropriation.

SEC. 6. This act shall take effect from its passage.

Approved November 19, 1888.

An Act to Provide for the Printing of the Report of the Vermont Dairymen's Association.

It is hereby enacted by the General Assembly of the State of Vermont:

SECTION 1. Section two hundred and forty-seven of the Vermont Statutes shall be amended to read as follows:

The Secretary (of Board of Agriculture) shall prepare on or before the 30th day of June annually, a detailed report of the proceedings of the Board with such suggestions in regard to its duties and the advancement of the interests herein specified as may seem pertinent, and he may append thereto such abstracts of the proceedings of the several agricultural societies and farmers' clubs in the State as may be advisable and the report of the Vermont Dairymen's Association. The report shall show under separate heads the work of the Board relating to the different subjects herein mentioned.

SEC. 2. The provision of Section two hundred and fifty-one of Vermont Statutes requiring the printing of a report by the Vermont Dairymen's Association is hereby repealed.

Approved November 4, 1896.

CONSTITUTION.

SECTION 1. This organization shall be called the "Vermont Dairymen's Association."

SEC. 2. Its object shall be to improve the dairy interests of Vermont, and all subsidary interests.

SEC. 3. This Association shall consist of such persons as shall signify their desire to become members, and pay the sum of one dollar, and a like sum annually thereafter, and of honorary and corresponding members.

SEC. 4. The payment of five dollars shall constitute a life membership, or the payment of an annual membership fee of one dollar for five consecutive years, shall constitute a life member.

SEC, 5. The officers of the Association shall be a President, two Vice-Presidents (one from each Congressional District), a Secretary, Treasurer and an Auditor, who shall constitute the Executive Committee, and have the general oversight of all the affairs of the Association.

SEC. 6. There shall be held, during each winter, an Annual Meeting, at such time and place as the Executive Committee may designate, for addresses, discussions, exhibitions, and the election of officers, who shall hold their respective offices for one year, or until their successors are chosen. Said meeting shall continue in session at least three days.

SEC. 7. It shall be the duty of the Secretary to prepare an Annual Report of the transactions of the Association for the current year, embracing such papers, original or selected, as may be approved by the Executive Committee, and cause the same to be published and distributed to the Dairymen of the State of Vermont.

SEC. 8. The Treasurer shall keep the funds of the Association and disburse them on the order of the President or Vice-President, countersigned by the Secretary, and shall make a report of the receipts and expenditures to the Annual Meeting.

SEC. 9. This constitution may be amended at any Annual Meeting by a two-thirds vote of all the members present.

OFFICERS

OF THE

Vermont Dairymen's Association.

1900.

PRESIDENT.

M. A. ADAMS, ... Derby

VICE-PRESIDENTS.

GEO. AITKEN, ... Woodstock

E. GORDON, ... Grand Isle

SECRETARY.

F. L. DAVIS, ... North Pomfret

TREASURER.

P. W. STRONG, ... North Pomfret

AUDITOR.

GEO. TERRILL, ... Morrisville

TABLE OF CONTENTS.

LIFE MEMBERS OF THE VERMONT DAIRYMEN'S ASSOCIATION.

Adams, M. A.	Derby
Allen, Charles	East Berkshire
Armstrong, A. B.	Dorset
Allen, H. A.	West Milton
Allen, Henry	Pawlet
Adams, William H.	Keene, N. H.
Aseltine, M. L.	North Fairfax
Aldrich, E. O.	Shrewsbury
Adams, G. W.	Stowe
Akley, E. H.	Dummer
Aitken, George	Woodstock
Benedict, G. G.	Burlington
Blake, Geo.	156 Congress St., Boston, Mass.
Bronson, T. G.	East Hardwick
Bell, C. J.	East Hardwick
Barstow, J. L.	Burlington
Barber, D. C.	Burlington
Brownell, C. W.	Burlington
Briggs, Nelson	Brandon
Brigham, William O.	Bakersfield
Buck, Abner	Buck Hollow
Buck, A. H.	Buck Hollow
Burt, William	Essex
Bliss, S. E.	North Williston
Burt, Frank	Enosburg Falls
Ballard, B. M.	Fairfax
Blair, N. B.	Morrisville
Bliss, O. S.	Georgia
Bliss, Abner	Georgia
Beecher, H. A.	Hinesburg
Bates, A. E.	Huntington
Barnum, Ell	Milton
Bent, C. C.	Marshfield
Brown, J. S.	Plymouth
Bishop, D. B.	North Williston
Bass, E. L.	Randolph
Blake, William H.	Swanton
Bell, F. C.	Swanton
Barry, Leonidas	Springfield
Burgess, J. J.	St. Albans

Brainard, E. P.	St. Albans
Bristol, R. T.	Vergennes
Bushnell, J. H.	Williston
Brownell, George W.	Williston
Barber, E. L.	North Williston
Bushnell, H. N.	Waitsfield
Butler, F. G.	Hartford. Conn.
Burrell, D. H.	Little Falls, N. Y.
Baker, J. W.	Syracuse, N. Y.
Brewer, J. R.	Hingham, Mass.
Burghan, W. H.	Montpelier
Beach, W. V.	Charlotte
Bent, Orrin	Boston, Mass., 57 Quincy Market
Brown, B. B.	Williston
Chaffee, J. H.	East Enosburg
Cilley, S. T.	Fairfax
Congdon, Edwin	Clarendon
Cannon, LeGrand	Burlington
Cahee, J. L.	Brandon
Cahee, L. J.	Brandon
Currier, P. W.	Berlin
Clarke, M. S.	Clarendon
Coburn, J. A.	East Montpelier
Coburn, J. L.	East Montpelier
Campbell, H. W.	Holdridge, Neb.
Cutts, H. T.	Orwell
Colburn, H. E.	Rutland
Crampton, J. W.	Rutland City
Chapman, J. H.	West Rutland
Cowden, H.	St. Johnsbury
Colburn, R. M.	Springfield
Crampton, Charles A.	St. Albans
Currier, J. W.	North Troy
Chapman, George A.	Williston
Cooley, William	Waterbury
Cobb, C. H.	Westford
Crane, George	Brookfield
Chase, C. P.	Proctorsville
Chandler, G. C.	Montpelier
Clarke, M. W.	Williston
Colburn, H. W.	North Pomfret
Douglass, O.	Boston, Mass.
Donahue, T. E.	Hinesburg
Dodge, Harrison	Morrisville
Davis, George	East Montpelier
Dwinell, L. G.	East Calais
Dwinell, Albert	East Calais

Davis, George F.	Cavendish
Dewey, Ed.	Montpelier
Dewey, Charles	Montpelier
Davis, C. H. E.	Headville
Douglass, B. J.	Pittsford
Davis, F. L.	North Pomfret
Denio, W. B.	East Rupert
Douglass, E. B.	Shoreham
Douglass, W. B.	Williston
Dagon, M. R.	Madison, Wis.
Deal, T. M.	St. Albans
Evarts, A. D.	Bristol
Ellis, I. L.	Middlebury
Eaton, I. H.	Plainfield
Eddy, H.	Waterbury Center
Fisher, L. C.	Cabot
Farrington, C. W.	West Danville
Fletcher, William	Essex Junction
Fassett, G. S.	Enosburg
Fassett, A. B.	East Berkshire
Field, D. L.	West Milton
Forbes, D. A.	Orwell
Frink, W. B.	Swanton
Freeman, H. O.	Sherburne, N. Y.
Gale, P. R.	Stowe
Grout, L. D.	Morristown
Grout, William W.	Barton
Giddings, W. A.	Bakersfield
Grout, Hon. J.	Derby
Grout, L. M.	Mass.
Gilson, Truman	Residence not known
Gibson, J. P.	Mt. Holly
Gloyd, Jesse	Richmond
Gilman, A. A.	Randolph
Gleason, H. C.	Shrewsbury
Goodspeed, Nelson	St. Albans
Graves, C. O,	Waterbury
Greene, E. G.	California
Hastings, S. J.	Springfield
Harvey, Cloud	Brattleboro
Hibbard, C. A.	Burt
Hills, J. L.	Burlington
Humphrey, A. O.	Burlington
Holden, Eli	Barre
Holliston, E. B.	Manchester Center
Hotchkiss, C. A.	Georgia
Hefflon, Franklin	Highgate Center

Hill, H. C.	Isle LaMotte
Hall, L. C.	Johnson
Herrick, A. A.	West Milton
Hall, Charles	Montpelier
Head, George G.	Montgomery
Harwood, J. W,	Orwell
Hall, R. D.	Orwell
Hines, Ed.	Pittsford
Hewitt, Stephen	North Pomfret
Higley, Nathan,	Richmond
Hodgers, R. W.	Randolph
Hopkins, Daniel	Waterbury Center
Huse, S. R.	Waterbury Center
Huntley, George M.	Westford
Healey, W. M.	Dudley, Mass.
Hopkins, Herman Jr.	Sheldon Junction
Hannum, P. C.	Weston
Isham, Ed.	St. George
Jackson, L. A.	Milton
Johnson, A. B.	Malone, N. Y.
Jaynes, R. F.	Ryegate
Kingsley, H. E.	Montgomery
Kinerson, J. R.	Peacham
Kidder, N. D.	Hastings, Neb.
King, M. D.	Woodstock
Kenfield, Frank	Morrisfield
Leonard, H. B.	North Pomfret
Leonard, N. O.	Fairfax
Lord, W. H.	Mechanicsville
Lane, B.	Newport
Loveland, Aaron	Norwich
Lyster, T. H.	St. Johnsbury
Lawrence, Henry	St. George
Maynard, H. S.	Bakersfield
McAllister, C. S.	West Enosburg
Mann, J. M.	Fairhaven
McDonough, P.	Hinesburgh
Marvin, Thomas	Montpelier
Moseley, F. W.	Clinton, Iowa
Miller, M. H.	Pomfret
Moore, A. A.	Richford
Morse, D. H.	Randolph
Maxham, G. R.	Woodstock
Macomber, D. H.	Essex Junction
McMahon, C. L.	Stowe
Macomber, W. H.	Westford
Mott, H. A. Jr.	New York

Nye, J. W.	Fairfield
Newton, C. H.	Fargo, North Dakota
Nash, D. W.	Belden
Nelson, Mrs. C. J.	Ryegate
Northrop, P. B. B.	Sheldon
Newell, Bigelow	Stowe
Newton, A. J.	Wallingford
Narramore, J. C.	California
Parker, F. J.	Grand Isle
Parker, J. B.	Whiting
Patten, J. P.	Williston
Paine, C. S.	South Randolph
Phelps, H. A.	Milton
Page, C. S.	Hyde Park
Pierce, G. W.	Brattleboro
Powers, William	Brandon
Peck, Cassius	Burlington
Pierce, C. C.	East Clarendon
Place, R. H.	Essex Junction
Peck, A. M.	St. Johnsbury
Perkins, W. E.	Pomfret
Richardson, A. E.	Burlington
Rie, Eli	West Charleston
Robie, W. C.	Franklin
Richmond, H. J.	Guilford Center
Roberts, D. W.	North Pomfret
Robbins, Henry	Middlebury
Riley, J. J.	Sheldon
Roberts, L. J.	Waterbury
Ruggles, E. H.	Westford
Rutherford, W. L.	Waddington, N. Y.
Rice, H. M.	Westford
Stafford, Charles	Chippenhook
Strong, P. W.	North Pomfret
Symms, E. E.	Ryegate
Slocum, A. R.	South Burlington
Stanhope, Spencer	Berkshire Center
Shaw, Daniel	Bolton
Smith, A. D.	Danby
Stevens, S. H.	Enosburg Falls
Snell, T. T.	North Enosburg
Stiles, G. M.	Morrisville
Sanderson, W. L.	Milton
Smith, L. M.	Milton
Sanderson, C. P.	Milton
Smith, F. E.	Montpelier
Snow, F. M.	East Montpelier

Seeley, H. M.	Middlebury
Smith, C. F.	Morrisville
Spaulding, L. C.	Poultney
Sherburne, J. C.	North Pomfret
Simonds, W. J.	Roxbury
Stoddard, M. A.	Rutland
Smith, N. E.	Richford
Smith, Francis	Swanton
Smith, F. V.	Stowe
Smith, George G.	St. Albans
Sowles, E. A.	St. Albans
Smith, E. G.	St. Albans
Stone, Alney	Westford
Sprague, N. T. Jr.	Brooklyn, N. Y.
Smith, E. A.	Boston, Mass.
Smith, F. B.	New York
Snow, Mrs. Edward	Swanzey, N. H.
Towne, E. B.	Milton
Taylor, A.	Burlington
Turmbull, J. G.	Barton Landing
Towle, E. R.	East Berkshire
Thompson, Eben	North Danville
Teachout, S. D.	Essex Junction
Tarbox, C.	Jericho
Thomas, Stephen	Montpelier
Tarbell, E. S.	Montgomery
Terrill, G. H.	Morrisville
Tinkham, O. M.	North Pomfret
Tottingham, L. H.	Shoreham
Talcott, D. I.	Williston
Talcott, L. F.	Williston
Talcott, J. I.	Oakland, Cal.
Tarwell, F.	Hampton, N. Y.
Terrill, M. W.	Middlefield, Conn.
Vail, H. W.	North Pomfret
Van Patten, W. J.	Burlington
Warren, S. H.	North Pomfret
Wells, Ed.	Burlington
Ware, O. T.	Brattleboro
Williams, W. H.	Rutland
Wright, Will	Brandon
Wheeler, N. B.	Brandon
Winslow, C. M.	Brandon
Washburn, Chat	Brandon
Williams, N. G.	Bellows Falls
Walker, N. S.	Clarendon Springs
Wright, Ellen J.	Colchester

Woodard, J. S.	Enosburg
Wheeler, Curtis	Fairfax
Wood, H. L.	Georgia Plain
Weed, E. D.	Hinesburgh
Warren, Rufus	Montpelier
Wheelock, H. R.	Montpelier
Walker, Willard	Montpelier
Whitcher, H.	Newbury Center
Wright, E. M.	Orwell
Whipple, Obed Jr.	North Pomfret
Whipple, W. C.	North Pomfret
Wheeler, F. H.	Proctorsville
Walker, James	Springfield
Whitney, R. M.	Springfield
Whittemore, R.	St. Albans
Warner, J. N.	St. Albans
Waller, M. D.	St. Albans Bay
Whitney, George W.	Williston
Whitney, Ed.	Minneapolis, Minn.
Wright, H. S.	North Williston
Wallace, Sidney	Waterbury Center
Weston, H. S.	Winooski
Walker, H. W.	South Woodstock
Williams, J. S.	Baltimore, Md.
Williams, G. B.	Walpole, N. H.
Williams, J. B.	Glastonbury, Conn.
Webb, J. T.	New Braintree, Mass.
Winslow, P.	Kankakee, Ill.
Winslow, H. M.	Kankakee, Ill.
Whitman, C. D.	Brattleboro
Weston, S. H.	Winooski

SPECIAL NOTE. A good deal of work has been done in revising the Life Member List of this association. Your Secretary has written the Town Clerk of every town where there were members on the last list published. The returns found many deceased, and other changes. Have endeavored to publish a correct list. Any errors found, please report to your Secretary.

ANNUAL MEMBERS 1900.

Allen, G. A.	West Hartford
Ayer, A. J.	Putney
Adams, G. W.	Stowe
Akeley, E. H.	Dumnmer
Adams, M. A.	Derby
Bigelow, C. H.	East Brookfield
Bond, G. W.	Guilford
Belden, H. W	Waitsfield
Betterley, C. C.	West Barnet
Bell, C. J.	Walden
Brock, L. C.	Barnet
Blake, G. W.	Boston, Mass.
Bush, L. O.	Underhill Center
Bean, G. C.	Coventry
Brothers, Henry	Williston
Beach, W. C.	Charlotte
Bickford, F. H.	Bradford
Bailey, E. S.	Lunenburgh
Bond, John	East Montpelier
Bruce, H. C.	Sharon
Bond, S. L.	Wilmington
Candon, J. B.	Chittenden
Candon, J. B.	Pittsford
Cole, E. M.	East Burke
Chamberlin, H. B.	Coventry Falls
Cochran, George	Ryegate
Cobb, Grant	Prosper
Campbell, J. M.	Morrisville
Crowell, George	Brattleboro
Carpenter, E. P.	West Waterford
Cameron, L. M.	Montpelier
Douglass, Orin	Boston, Mass.
Donahue, D. G.	East Charlotte
Donahue, M. F.	Ferrisburgh
Donahue, J. F.	Lincoln
Donahue, F. E.	Hinesburgh
Doe, G. A.	Corinth
Edson, E. A.	Chester
Eaton, W. Z.	Hartford
Evans, John	West Pawlet
Eastman, Emilie	Passumpsic

Fish, H. Z.	Sugar Hill
Faxon, G. A.	Pawlet
Franklin, Mrs. W. A.	Vernon
Foote, C. P.	Middleboro
Gould, J. D.	Passumpsic
Gallup, J. A.	West Woodstock
Gates, Charles & Son,	North Hartland
Gale, J. E.	Guildford
Gordon, E.	Grand Isle
Green, G. F.	Woodstock
Hatt, B. A.	South Ryegate
Hayward, G. W.	East Corinth
Hastings, C. A.	Springfield
Hosford, C. J.	Wells River
Hayward, F. R.	Topsham
Haskins, Kittredge	Brattleboro
Haynes, W. S.	Middletown Springs
Hewitt, D. D.	North Pomfret
Hamilton, J. W.	West Brattleboro
Hunt, E. W.	Danville
Harrington, W. H.	North Pomfret
Humphrey, G. W.	East Burke
Holt, M. S.	Sunderland
Hunter Brothers	Lyndonville
Jewett, S. W. & Son,	Middlebury
Jaquith, R. E.	South Woodstock
King. M. D.	Woodstock
Kneeland, D. A.	Waitsfield
Kibbey, F. L.	West Fairlee
Kelley, G. A.	Marshfield
Loveland, J. H.	Norwich
LePage, Charles	Barre
Leonard, H. B.	North Pomfret
Lawless, C. C.	Montpelier
Leach, W. B.	Essex Center
McKinstry, A. P.	Winnebago, Minn.
Miller, J. R.	Westminister
Noble, H. A.	West Brookfield
Nichols, H. L.	Hale
Nay, Y. G.	Jericho
Norcross, W. C.	Hortonsville
Porter, W. C.	Sharon
Perkins, W. E.	Pomfret
Putnam, F. A.	Wethersfield Center
Parks, N. A.	South Ryegate
Parker, B. C.	Ferrisburg
Ricker, N. H.	Ryegate

Roberts, D. W.	North Pomfret
Richmond, Frank	Hale
Rice, H. W.	Westford
Russell, F. L.	Shrewsbury
Robinson, A. C.	North Underhill
Sherberne, E. C.	North Pomfret
Sherburne, Sumner	South Pomfret
Swan, P. B.	Montgomery
Simpson, W. G.	Washington
Stevens, W. C.	West Glover
Smith, B. R.	Passumpsic
Sanborn, H. M.	South Peacham
Smead, C. D.	West Brookfield
Sprague, George R.	East Brookfield
Scarff, C. W.	Burlington
Smith, F. C.	South Windham
Stafford, Charles	Chippenhook
Stone, W. P.	Strafford
Storrs, A. A.	East Bethel
Stone, M. S.	Montpelier
Symes, E. E.	Ryegate
Smith, F. L.	Fletcher
Scott, E. V.	Greensboro
Thayer, H. D.	West Brattleboro
Tuttle, G. W.	Pittsford
Thorber, J. W.	Brattleboro
Tucker, D. E.	West Halifax
Turnbull, J. G.	Barton Landing
Whitehill, C. E.	Barnet
Whitcher, J. R.	South Ryegate
Watkins, W. H.	East Hardwick
Wilcox, G. I.	Woodstock

REPORT
OF THE
THIRTIETH ANNUAL MEETING
OF THE
VERMONT DAIRYMEN'S ASSOCIATION,
HELD AT
BRATTLEBORO, JANUARY 9, 10, 11, 1900.

The meeting opened Tuesday at 10.30 a. m. in Grange Hall with President G. W. Pierce in the chair. Rev. R. K. Marvin invoked Divine blessing. A very cordial welcome was extended to the Association by Col. G. W. Hooker in behalf of the citizens of Brattleboro; responded to by M. A. Adams of Derby, President of the Vermont Butter and Cheese Makers' Association, hearty welcome from C. S. Hopkins in behalf of Protective Grange, responded to by C. J. Bell, Sec'y State Board of Agriculture. J. G. Stafford welcomed the Association in behalf of Brattleboro Creamery Association, responded to by A. Messer, late lecturer of the National Grange, Rochester, Vt.

PRESIDENT'S ADDRESS.

G. W. Pierce, Brattleboro.

Members of the Vermont Dairymen's Association, Ladies and Gentlemen :

In accordance with established custom it becomes the duty of the president at this time to deliver an annual address upon the work of the Association, and to offer suggestions on subjects relative to dairying. It is not my intention today to tire you with a lengthy address concerning matters foreign to our work, but simply, in the brief time alloted me, to offer a few thoughts touching upon different phases of dairying. Before entering upon the work assigned me, it may be well for us to consider for a moment the work accomplished in the past. This is the thirtieth annual meeting of the association. The Vermont Dairymen's Association is the oldest Dairy organization in the United States, being formed in 1870. Well can we be proud of its work when we stop to consider that Ver-

mont leads the world in the production of fine butter. May we not believe, and that truly, that the success of the Vermont dairymen is largely due to the aid received through the efforts of our association. Thirty years of untiring work in the cause of dairying has caused our association to rank high in comparison with simliar organizations. In the early days many discouragements were met but through the pluck and energy of its officers at that time it gradually worked its way to the front. Since State aid has been received, the work of the association has been broadened and every effort has been made to raise the standard of dairying and to help the dairy farmer to realize higher prices for his market products.

The financial standing of the association at the present time is good. Nearly one hundred dollars of the state appropriation was not used the past year, although in average years it would be. The combined meetings of the Butter and Cheese Makers' and Vermont Dairymen's Associations have resulted in good work for us all. Still your President would urge the early consolidation of both, believing that much more good would be acomplished under one head than two. Vermont is comparatively a small state and hardly able to maintain more than one dairy organization. We are aware that both the creamery and private dairying interest should be equally recognized, as both are largely represented in the state. One organization well officered with all interests represented would accomplish greater results than would two associations.

In reviewing the dairy situation in the country at large we are aware that there are sections, and especially in the west, which are producing a high class of dairy goods. This should rouse us to use every effort and to work with a stronger determination to keep in the front rank. This can be done only through our most energetic efforts to attain a higher standard in dairy goods. Vermont is naturally adapted to dairying; more grass, more corn of the best quality is produced per acre than in any other state in the Union; pure water, unadulterated, an important factor, flows from our hillsides. The question has often been discussed of late, how shall we meet the western competition; its answer may be summed up in a few words, produce a better article. This can be brought about only by a strict application to business. We must constantly study the latest improved methods, constantly seek new ideas. When we see a neighbor making a better quality of butter or cheese we should strive to learn his methods. Every butter or cheese maker,—and this should apply to the private dairyman as well as to the creamery or factory owner, — should be educated for the business, should make dairying a study. And yet even then he alone cannot make good butter; for first of

all; to be successful a pure product is needed, and this is assured only by care in the selection of the dairy herd and its handling. 98 point butter never was obtained from a herd of scrubs or diseased animals fed on unwholesome food and kept in unsanitary stables. It is a wonder that the creameries are able to make as good a quality of butter as they sometimes do from cream obtained from objectionable herds and stables. Some creamery managements have adopted the rule that each patron shall be visited from time to time, his cows, stables and surroundings closely inspected. Where this method has been employed the class of the product has invariably been raised. Submerging the cream in water is required of each patron by some creameries. Such methods should be followed by the private dairyman as well. We would recommend that a uniform card be adopted for use by the creameries of the state, containing special sanitary requirements, and that it be posted in the stable of each patron. It then should be the duty of each creamery management to inspect the premises of each patron from time to time and to offer suggestions to those failing to live up to to the required rules. Those who do not produce a pure cream after a reasonable number of visits, should be excluded. Better produce a higher quality of goods even if less in amount; the market demands only the best.

We must not linger here for fear we may be taking up the subject of creamery management. We simply want to impress upon your minds the great need of producing pure cream in order to obtain gilt edge butter. The best butter in the world is produced in Vermont; yet it also is true that some of the worst likewise originates among our green hills. This being true, do we not need dairy associations, dairy schools and agricultural colleges to educate ourselves in the art of butter and cheese making?

Comparatively few attend farmers' institutes, but those who avail themselves of these opportunities are the ones that are classed as the most successful farmers.

OUR MARKETS.

We should keep in touch with the markets both at home and abroad. The demand for first class dairy products always exceeds the supply, but the market is often glutted with inferior products. One-half cent per pound means much to the producer where any large amount is sold. Are we receiving that one-half cent? Our success depends in a great measure upon the marketing of our goods. Let us sell as direct to the consumer as possible. If we produce a first-class article, we shall have no difficulty in disposing of our goods. We cannot afford to market any other grade than the best. Allow me to

say at this time that in our opinion it is costing more per pound to produce an inferior article than it is to obtain the highest priced product; this follows in all kinds of business. In the production of butter and cheese where all the modern appliances are used, the cost is less than where the old rude methods are employed.

Every dairyman should have his butter scored from time to time by competent and disinterested judges, who are familiar with the demands of the market. He may thus discover his weak points, if any, and be thereby enabled to correct them.

As we raise the standard of our dairy products the greater will be the demand both at home and abroad. The Secretary of Agriculture in his last report says: "Encouraging results have come from the introduction of dairy products into foreign markets. The department sends shipments abroad for the purpose of ascertaining the facts regarding such products, these facts are published and commerce naturally follows."

DAIRY LAWS, STATE AND NATIONAL.

Every farmer should be familiar with the dairy laws of our State and Country. The present laws are designed to encourage us in the production of a higher class of dairy goods, and to protect us from fraudulent or imitation butter and cheese. Are we living up to these laws? Are we producing pure milk and cream for the factory or creamery as the law demands? It is a pleasure to say as far as we know that the present laws have not been resorted to in helping to keep the Vermont farmer in line. The farmers of our State are progressive as a whole and ready to adopt new methods when offered to them in a practical light.

FRAUDULENT GOODS.

The country still abounds in imitations of butter and cheese sold under the name of the pure product. Constant fines are being imposed, yet illegal sales go on. Stronger laws along this line should be enacted and enforced. It is the duty of the producer as well as the consumer to aid in securing more stringent laws both state and national, and once secured, in enforcing them. It has been said man cannot be made honest by law; but law can make dishonest men pay the penalty when they sell fraudulent goods under the name of the pure article. The universal demand for cheap things brings a supply of imitation goods. Flour is adulterated with corn. "Pure Vermont Maple Sugar" is made that never saw the Green Mountain State. Milk is robbed of its cream, filled with lard, sent over the entire globe, and ruins the reputation

of American cheese. Oleomargarine may be made as a pure product, but we understand that certain analysis made in the state of New York have disclosed the fact that oleomargarine is manufactured containing as high as 12 per cent of parafine, an indigestible substance.

I would urge upon each farmer in the state to use his influence to further both state and national legislation for the enactment of stronger pure food laws. It is hoped that our association at this time will adopt resolutions urging the passage of the bill H. R. No. 3717 relating to oleomargarine and other dairy products, which has already been presented to Congress by our representative Hon. W. W. Grout.

DAIRY SCHOOLS.

The leading industry of our state, dairying, demands as thorough an education as any other branch of business. Our Dairy Schools are an important factor in aiding the farmer of the present day to attain that information which he should have in order to thoroughly understand his business. Here the use of the latest improved dairy machinery is taught, and, by the way, the very best machinery has been discarded many times by farmers through lack of knowledge of its working. The latest improved methods are taught by experienced persons at these schools who have made dairying a study. We are of the opinion that a young man before taking up dairying as a business should have at least one thorough course of training at the dairy school. The time is not far distant we believe when all creamery managements will require of the butter makers to take a course of training at some dairy school that they may have a more thorough knowledge of the art. The variations observed in the tests of milk are due largely, we believe, to lack of thorough knowledge by butter makers of the use of the Babcock apparatus. Rapid strides have been made in the last few years along the line of butter and cheese making. This advancement without doubt in a great measure is due to the work and influence of our dairy schools.

OUR AGRICULTURAL COLLEGE.

Too few young men in our state avail themselves of the opportunity of securing an education at our Agricultural College. The profession of farming today being classed as one of the sciences, demands a thorough knowledge of the composition of the soil, as well as the proper use of fertilizers and crops. This can only be obtained by a thorough course of study. The University of Vermont offers special inducements in this respect.

BY-PRODUCTS OF THE DAIRY.

Are we realizing all that can be obtained from by-products of the dairy? Butter and cheese making yield three well known residues which constitute the by-products of dairying; skimmilk, buttermilk and whey. Experience has taught us that for every pound of butter made there are from fifteen to twenty pounds of skimmilk and about three pounds of buttermilk, and for every pound of cheese nine pounds of whey. We are told "that the butter and cheese annually produced in the United States leave as residue not less than 24,000,000,000 lbs. of skimmilk, 4,000,000,000 lbs. of buttermilk and 2,500,000,000 lbs. of whey." The sale of these by-products is usually by the barrel. The variation in price of skim-milk and butter-milk ranges from nothing up to 30 cents a barrel in Vermont. This wide variation in price indicates that the by-products of many creameries are not fully utilized. This is a matter of great consequence and is well worthy of our careful consideration. Those who have made this a careful study claim that the most money could be realized from skimmilk if it were sold as a human food in its natural uncooked state. Is it possible for the Vermont dairyman to find such a market for his sweet skim-milk? This certainly is worth our consideration. Most farmers use their skimmilk as feed for calves and pigs, and, without doubt, good returns are received when fed to either judiciously; but it is our opinion, with the present prices of cattle and swine, that more can be realized by feeding our skimmilk to high grade heifer calves than by making it into pork. The market continually demands good cows, which can always be sold at good prices. Experiments made have proved that the greatest profits are realized by feeding skimmilk to young calves and pigs and that less profit is realized when it is fed to older animals.

TUBURCULOSIS.

Through the use of the tuberculin test, in the hands of competent persons, this disease will in time be eradicated in our state. Vermont leads all other states in the handling of this much dreaded disease. Without doubt if Vermont wishes to retain its fair name as a dairy state it must continue to weed out its diseased animals. Such states as have no laws relative to this subject are suffering greatly in consequence. Among the valuable aids in helping to lessen the spread of this disease are clean, well ventilated stables, where the sunlight can enter. Where the disease is found to exist the herd should be tested once each year for three consecutive years. This will usually take out all cattle affected with the disease. Great

care should be taken to disinfect the stables thoroughly. Unless this is done, the disease is very sure to break out again. Test your herds as soon as the disease is suspected. It means too great a loss to wait longer.

GENERAL REMARKS.

There are said to be 17,000,000 dairy cows in this country, one to every four inhabitants; still the demand for first class dairy products exceeds the supply. The perfection of milk as a human food has been demonstrated beyond all doubt. The demand for the products of milk is sure to increase both at home and abroad. The United States is especially adapted to dairying. No country in the world produces so many useful grasses and forage plants. The great indigenous crop, corn, the food which produces the finest quality of butter, is raised more largely here than in any other country. Our foreign friends, the Danes, are realizing its value as a dairy food, and are importing large quantities. Statistics show that in 1898 16,874,943 bushels of Indian corn were imported by the Danes from the United States. More corn should be raised in our own state. We buy too much. Here the question of our abandoned farms may well be taken up. It is a matter of great regret that these farms with their natural fertility. especially adapted to raising grass and cereals, are lying idle. Will the young men of Vermont reclaim them? Or shall we have to give them up to the foreign element? The present outlook is that the demand for abandoned farms in New England will greatly increase, and that this will be brought about largely by the growth of dairy interest. The rural free delivery of mail, and the just interstate commerce laws, when fully realized, will be important factors in this direction. Time will prevent further discussion. It has been my pleasure to hold office in this Association for the past six years. In turning over the work to another I can only say that I trust that my successor will find the work as pleasant and profitable as it has been to me, that through his efforts the Association will be raised to a higher plane of usefulnss.

Afternoon Session.

PROFITABLE ADJUNCTS TO DAIRYING.

M. L. Aseltine, North Fairfax.

Every dairy man keeps or ought to keep hogs and while many, with ten or twelve cows, raise about pork enough for their own use, it is possible to double or thribble the income from the hogs on the average farm. To begin with get good stock, registered if you can, as that pays the best. Then advertise in your local or county paper not spasmodically but regularly, and aim to sell your pork products as pigs or shoats and not as pork. The profit is much greater. From one male and four females I sold $270 worth of pig, shoat and pork in 1899.

Farm stock will be just what the owner makes it. This is true of swine to a greater extent perhaps than of any other animal on the farm. They can exist under adverse conditions and live with less care than any other stock except, perhaps, the hen. On the other hand they will more readily respond to good care and feed than any animal we raise on the farm. They can eat anything from spring water to oat straw and grow upon it if given something else to fill out the ration.

Should the dairyman not care to sell breeding stock, his aim should be to get the breed of swine best adapted to his individual surroundings. The man who is forced to keep his swine in a small pen needs a different breed than the one who has large hog pastures.

In most markets the demand is for a pig that will dress 125 to 200 pounds with as much lean meat as can be had. The time when tons of lard can be sold as pork has passed away. Hence in the selection of breeding stock we should try to get such as will weigh from 100 to 200 pounds in the shortest time with the minimum amount of feed. But whether thoroughbred or scrubs are kept remember that your profit is gauged by the feed and care given. Do not think that because he is only a hog that anything is good enough for him. He appreciates good sweet feed and a dry bed and will show his appreciation by turning the waste products of the farm and dairy into that very useful commodity, money; and he will do this

with less care and expense than can be accomplished in any other way. In whatever light you view him, the hog is the most profitable adjunct to the dairy. Not only does he use every scrap of waste in the butter and cheese making but if given the opportunity will utilize all the other waste products of the farm and garden.

The hogs greatest sphere of usefulness upon the farm, however, is as a manufacturer of fertilizer. If given the proper material — and he does not require you to buy nitrogen, phoshporic acid and potash in available form to turn out a fertilizer — muck, leaves, straw or litter of any kind, and he will furnish gratis fertility that will discount anything that can be bought in bags, taking into consideration the cost and lasting effects. Give him the opportunity and next fall you will not find it necessary to call on one or two of your best cows to pay for phosphate. One of the best farmers of my acquaintance has his hog house so arranged that there is only about four feet of floor in each pen and that is where the feeding trough is placed; the balance of the pen he keeps filled with muck or straw about two feet in depth, and that is drawn out twice a year.

Two hogs well kept ought to produce about three cords a year of the very best fertilizer. It may be easier and does not take much time to draw and apply the chemicals but it requires quite an effort to meet phosphate bills with the cows nearly dry as they usually are in the fall when most of the commercial fertilizer is paid for.

While the dairyman usually wants all that his milk, butter or cheese will bring on the market and will spend time and money to that end, the going price for his pork products seems to be satisfactory. There are very few localities in New England that produce pork enough for home consumption, if such products were placed on the market in a marketable form. From our shipping station at St. Albans, car loads of hogs are shipped to Boston and New York at a price that barely pays for the time taken to feed and care for them, and perhaps the same trainmen that take live hogs away, bring on their return trip car loads of salt pork, bacon, hams, sausage, lard, pickled feet. In fact, I have no doubt but that hogs shipped out of Franklin County in May or June have come back to it before September, having paid freight charges both ways while four or five different commission men have taken their toll. All of this should have gone into the pocket of the dairyman who first produced it.

As two or more horses are usually kept to do the necessary work on the farm I think one or more of them should be a good brood mare. The dairyman should raise at least one colt each

year. The farmer can easily plan so that the coming of the colt will not interfere with the farm operation to any great extent; and with the present prices for horses of the right kind there is no branch of farming which will pay better. And right here lies the secret of success or failure. The farmers, yes, and horse breeders of Vermont, have lost hundreds of thousands of dollars trying to get trotters and while experience has shown that our climate is not adapted to the developement of extreme speed, the majority of farmers are keeping right at it, the usual result being a useless plug.

Now I believe that our hills and climate are such that we can raise three types of horses which will sell at good figures, the carriage horse; roadster and draft horse.

The first is the carriage horse. He should possess unusual symetry, fullness of body and above all things coach or carriage action. He should stand close to sixteen hands high, upheaded with smooth conformation, plump with muscles and have sufficient weight to easily move a heavy carriage. The action required in this type is the most necessary characteristic. It is not necessary to go into details further than to say that the high knee action and the high lifting movement which indicates spirit and force rather than rapidity is what is wanted.

The roadster or as the market knows as the gentlemen's driver, is a horse of a type quite different from the carriage or coach horse. He is trimmer built, appearing somewhat racy. His purpose is to contribute to the pleasure of some one who enjoys driving and at times speeding with competitors. Such a horse should be able to show a rapid gait and maintain it. The action of this horse differs considerably from that of the carriage horse as speed is one of the important considerations in this type.

The horse that seems to fit into farming production better than any other is the draft horse. He should be of good weight, 1200 to 1800 pounds. Horses of this kind are salable at any time at a fair price. He should be massively built, deep bodied, heavy in muscle and short in limbs, with feet properly constructed of durable material. Such a horse can be economically raised on the farm.

The farmers' advantages enable him to produce the different types of horses cheaper than any one else. Horse labor on the farm is necessary and there is every reason to believe that to get the best results in breeding, some labor for a brood mare is desirable. Not many farms have the ability to furnish the carriage horse and gentlemen's driver. The farmer may breed with great success these types of horses and make it profitable and if he is content to take a fair price for them

and let the dealer manner and completely finish them for the market; but in breeding draft horses the farmer is able to secure all the price of his labor for the draft colt will begin to pay for his keep at three years old and at five years old need not owe the farmer a dollar for feed or care.

Do not make the mistake of using any sire that may be near you; get a good one even if the service is ten or fifteen dollars more. Ten dollars saved now may mean $150 lost when the colt is five years old.

There always has been and I believe there always will be a place at a good price for the right kind of a horse.

Poultry keeping is another very profitable adjunct to dairying. While every farm has its flock of hens which pays a handsome profit in fresh eggs and chickens for the farmer's table, very few consider poultry as a source of income. It is conceded that 100 pounds of skim milk will make as many pounds of eggs or poultry as it will of pork or veal. One can easily see where the poultry pays the best. With me the hen is the only variety of fowl that will use skim milk. Geese and turkeys won't touch it and I do not care to have them.

In poultry raising, nature's laws are to be respected if success is to follow. Fowls when wild live entirely in the open air. The hen being a native of a portion of the globe having a warm climate, require good warm buildings in all seasons of the year. But the turkey, being indigenous to this country, does not require shelter of any kind, summer or winter, in fact the profit will be lessened if he is confined at any period of his existence. In this respcet, his majesty, the gobbler has a great advantage over all other kinds of domestic poultry, and where turkey raising can be carried on, no other branch of the poultry industry can approach it in profitableness. Turkeys do not need feeding if given free range. The first requisite in turkey raising is a good fox hound, one that isn't afraid to tackle a pole cat. If you have this kind of a dog the rest is easy. There has been so much printed about how to raise and manage the hen for eggs and poultry that I will not take your time explaining my methods but with the turkey it is different. While my methods may not be original they are at least successful.

I get as good breeding stock as can be had, being very careful not to inbreed, for there is no stock that will show the evil effect of inbreeding as quickly as the turkey. I do not feed much corn or fattening food to breeding stock. Oats and buckwheat are the best feed through the winter. Be careful and not have them lay too early; starve them a little as the eggs are apt to get chilled and not hatch. When the mother

turkey wishes to commence laying she will let you know it by a noise peculiar to her at that time. Spend a few hours with her then to make her lay where the foxes and skunks cannot get to her nest. When you have done this success is in sight for with a subsequent severe letting alone the young are hatched and the loss should not be over ten per cent. When the hen is first giving eggs sprinkle insect powder in the nest and three or four days before she comes off with the young turkeys repeat the operation. When the eggs commence to hatch do not go near the nest for thirty-six hours. At the end of that time all the eggs should be hatched which are good. If you molest her while hatching she is very liable to crush some of the young turkeys. When they are all dried off and can walk put them with the mother out in the pasture or any place where the grass is short. Then if you have a good hound you can let them take care of themselves unitl they get large enough to go on to a roost. At this time it is a good plan to get them up every night for a week or so and feed them a little corn or buckwheat. At the end of a week at about sundown or a little before, your turkeys will come home to roost but of course they expect a little feed. Do not disappoint them; if you do you will have to do it all over again. My loss the last season was only 7½ per cent. of what came off the nest.

The best time to dispose of the increase of the flock is at Thanksgiving. The turkey is a national bird at that time. Good prices are usually paid then, better than at any time in the year and the larger bird brings the best prices every time; so that the turkey carrying the most pounds at that time, brings the most money. I shall not discuss the merits of the different breeds further than to say that while an eight to ten pound turkey was worth thirteen to fourteen cents per pound last November, one that weighed fourteen to sixteen pounds brought sixteen to seventeen cents per pound. In the larger bird you not only get the added number of pounds but get from two to three cents per pound extra for every pound the turkey weighs.

"AMERICAN DAIRY PRODUCTS AT THE PARIS EXPOSITION, 1900."

HENRY E. ALVORD, Washington, D. C.,
Chief of Dairy Division.

Mr. President, Ladies and Gentlemen:

It is my duty as well as my pleasure to give expression to the greeting which I bring from the Secretary of Agriculture to this Association and this Convention. Secretary Wilson firmly believes that the farmers and dairymen of this country should come together, confer and co-operate for the purpose of improving and advancing their interests. Meetings of this sort, therefore, are always interesting to him, and he sends his best wishes in this case as he always does to Associations of this kind. His instructions to all who are serving under him in the United States Department of Agriculture are to do all they can to assist and encourage organizations for mutual benefit, of this character, associations of farmers of every kind, dairymen included, in all parts of the country.

It is always a pleasure to me to be able to leave my duties at Washington long enough to meet with representative men and women from the farms of the country in conventions of this sort, and is particularly a pleasure to me to come back so near to the place of my birth—to a neighborhood with which I was entirely familiar in my boyhood and to meet the people, many of whom I have met before on similar and other occasions.

It is the conviction of those who have studied the dairying of this country for the last few years, that although at the present time we furnish a better market for our dairy products than can be found elsewhere in the world, and although most of the time for the several years past our home markets have been better than any foreign markets, yet it is probable that the time is not far distant when we shall have need to extend the markets for our dairy products.

We are all familiar with the rapid increase in agricultural production, in the export of the agricultural products of this country to the various parts of the world, and the enormous trade which is being built up in the products of the American farm in all quarters of the globe; and there is every reason to believe that among those exports in the near future, dairy pro-

ducts will take more and more of a place. Consequently it behooves us to advertise our goods in this line, and the Congress of the United States, in arranging for a proper representation of the industries and products of this country at the Paris Exposition this year, provided that there should be a good general exhibit of our agricultural resources and products; and that they should be made under the immediate supervision and direction of the Secretary of Agriculture. And he, in turn, determined that there should be included in the agricultural display at Paris a representation of the dairy industry of the United States. That part of the work has been assigned to me and, without attempting to go into much of a description, I will very briefly make this statement in regard to it :

It is proposed to make this dairy exhibit essentially commercial in character, not attempting to do much toward educating people in other parts of the world as to America and American resources in the dairy line, but more to show to buyers in all parts of the world who attend this exhibition at Paris, the kind of dairy products which we have in this country and have to sell if they will pay us a fair price for them.

We propose, therefore, to make this an exhibit of the products such as we have to sell, and largely in a form suitable for sending to foreign countries to be sold.

One of the articles which those present here do not know a great deal about, personally, though some of you do in a general way, one which is becoming quite an article of commerce and enters quite largely in our foreign trade is condensed milk. You have one large and flourishing condensery in this state. Condensed milk is a considerable article of export. Milk condensed in the United States is in almost every portion of the globe. The people who cannot buy dairy products, or perishable or semi-perishable farm products, buy canned condensed milk among the first articles they take from us. I believe in recent years the Chinese have increased their purchase of condensed milk in this country more than almost any other one article. China and Japan buy largely of condensed milk, and condensed milk goes wherever shipping goes, and wherever there are distant settlements where other milk cannot be easily obtained — hot climates especially. Consequently this is one article we must do the best we can to advertise through the Paris exhibition, and an effort will be made to make a large and attractive exhibit of the condensed milk of this country.

The Vermont factory to which I referred has already sent forward its exhibit and it is now on its way across to Paris. That will be easily managed because we can send over this condensed milk in hermetically sealed cans and have it there all through the exposition.

Cheese can be managed with comparative ease with the exception of soft and finer kinds. We can probably show the standard cheese of this country, and those varieties we have been in the habit of exporting during the past years — these, I say, we can show sufficiently by sending over two or at the most three shipments to Paris. We can keep the cheese in a good condition there in a large double refrigerator which we shall have for our butter products, and a collection has already been made from that which was made in September and October to send over the first of April, which will exhibit what this country does in the way of cheese making, during the opening months of the Exposition. We are also arranging so that good cheese shall be had to make a second shipment as soon as we shall have the other goods to send. It may be necessary to make three shipments to carry cheese through the last three months of the Exposition.

The intention is to have good cheese at Paris all the time so that any day the Jury of Award or representative of foreign countries, that were likely to become buyers of American cheese want it, it can be got, and they be satisfied that we have a good article. We expect to keep cheese on hand from various cheese making states so that it can be shown this industry is well spread over the different parts of our country.

The exhibit of butter will be a little more troublesome. We hope to accomplish that satisfactorily and creditably. It is the intention to ship butter every three or four weeks, and special carriers are being made now under my supervision in which about one hundred pounds of good butter can be sent from New York to Southamption, England, where the carriers will be re-iced without exposing the butter and then shipped by way of Havre to Paris. We think we have got the transportation pretty well completed so that the butter will reach Paris in as good order as it leaves New York.

All the butter and cheese will be carefully inspected before leaving New York. We have a store-house there where every thing will be carefully examined and nothing will be allowed to go from New York but what is good at the time and promises to remain so until it reaches Paris.

After arriving at the ground at Paris everything will be examined again and nothing will be placed on exhibiton unless at the time it is examined after arriving there, it is a first class article which will do us credit when seen by the people of other lands.

We can send over butter every three or four weeks and take special pains to send butter in sealed packages, canned butter, which is especially adapted to long journeys, for it is butter in this form in which we are especially desirous to increase

our trade. So far as the markets of Great Britain are concerned the Pairs Exposition is hardly necessary to give us a foot hold there, but we want to show other parts of the world what is being done in the way of the milk supply of cities and towns in this country, how far we have advanced in the way of producing good dairy milk and how well we can handle it and keep it. Here and there—not every town I must confess—we have some of the best and most carefully conducted milk and cream producing establishments in this country; and I have already arranged with some of those to send bottled cream, fresh cream to Paris next summer, about once a week, in such shape that it shall be guaranteed to keep sweet there for a week or ten days after arriving, and this without any preservative whatever. This is already done to some extent in connection with the shipping trade on our Atlantic coast. It is no uncommon thing for passenger steamers to take a supply of cream, sufficient for their entire trip, to go across the Atlantic and back again with the surplus cream sweet on their return. And there is a dairy at San Francisco which supplies and puts up cream so it will stand the long hot voyage across the Pacific to China and Japan and have it remain sweet to the end of the voyage. It don't come back again, that would be too much.

More than this, one enterprising dairy in New York has offered to supply us with fresh bottled milk twice a week in Paris next summer guaranteed, every lot of milk which arrives there shall remain good and sweet until the next lot arrives. No preservatives or chemicals are to be used in connection with this milk, simply cleanliness and cold. And by producing milk under the most favorable conditions keeping it pure, reducing it quickly to a low temperature and holding it there, there is no particular difficulty with keeping milk for this length of time. We hope to have at Paris every day, milk and cream served in bottles from American dairies, as it would be served in New York or Boston, and as good as it could be got there.

You have read more or less of the arrangements which have been made to have a sort of Aunt Jemima show there in connection with the exhibition, all sorts of cooked dishes made with corn meal as a basis. So far as my experience goes, and I have something of an education along that line, the consumption of corn bread does not amount to much unless you have plenty of good butter to go with it. So I have made a sort of business arrangement with this corn kitchen by which I am going to work off my extra supply of butter on them, and the American Corn Kitchen is to be supplied all the time with American butter and cheese. We propose to have Europe

sample our butter and cheese there and probably milk and cream from this country also.

I was requested yesterday before I left Washington, to say to this meeting that among the other articles which this corn kitchen will serve to the public at the Paris Exposition, will be corn griddle cakes; and the management of this kitchen, which is to be under the control of the Department of Agriculture, would like some good Vermont maple sugar. The Department is ready to receive proposals from Vermont to contribute maple sugar to be used in this way.

We shall have large exhibitions in connection with the dairy department. As far as dairy tools and implements are concerned the exhibit will not be much although I have made a selection of certain things which are articles of our own invention, or which we have so improved that I think they should not be omitted; but we do not expect to go into any large exhibit of dairy implements or machinery. The trade of this country in that line is limited, and, moreover we leave that to the enterprising manufacturers of those lines to look out for themselves.

By the way, the Vermont houses are to be represented, not through the government exhibit but by private exhibits of their own.

This is about the whole story. In summing up it means that, obtaining the products wherever they can be gotten good enough from the different parts of the country, we propose to use every possible exertion to carry them carefully to Paris. and to exhibit them there in such a way that they will attract attention, command respect and compare favorably in appearance with the dairy products of other parts of the world. While this exhibit is to be under the supervision of the dairy department of the United States and while we are to show the dairy industries of the country as a unit, yet full credit is to be given to the maker and contributor of every separate article. If the butter or cheese maker from the state of Vermont sends his or her products to be included in this exhibit they will be entered in the name of the manufacturer or contributor and will be so catalogued ; and such credit, such recognition as they receive by diploma or medal. will go to the individual who makes them, not to the Government of the United States which simply acts as an agent. I hope while I am in the town to make arrangements to secure large representations of the dairies in Vermont in this coming United States exhibition at Paris.

We take the goods at the place where they are made. The government bears all further labor and expense and exhibits in the name of, and to the credit of the maker or contributor.

At the last international exhibition held in Paris ten years or more ago, the State of Vermont won the highest honors of the world on butter. This was due to the public spirit and enterprise of the proprietors of the GreenMountain Stock Farm in supplying the government. This time we hope to have a larger exhibit, and that we shall be able to act as a useful and efficient agent in securing a satisfactory exhibit of our dairy industries on this occasion; the object being, as I have said, to show to the world through this Paris exhibition—which is to be visited by people from all parts of the world—what we can do. It is an opportunity to do a good piece of Yankee advertising.

President Pierce. There will be an opportunity of a few minutes for any person to ask any questions of Maj. Alvord. What has been the outcome of the governmental dairy exports which have been made?

Maj. Alvord. Greater confidence has been given to merchants, especially in Great Britain, in the ability of this country to furnish a satisfactory article in butter and cheese, and to deliver it in the markets in prime condition. I think merchants were rather in doubt as to our ability to do this. Their experience has been with the low grade of goods, but the Government has sent nothing but the best, and thus we have endeavored to give a character to our products of this conntry. As a result of this work, there is a pretty active demand for American butter and especially for American cheese. The latter has always been in demand. During the last year or two there has been more of a demand than our merchants were inclined to comply with because with the exception of a few weeks last summer our own people have been willing to pay more than foreigners, so the work has been of a prospective kind.

President Pierce. What has been your experience, and what is your opinion in regard to preservatives in butter?

Maj. Alvord. First and foremost, that we do not need them and hence it would be foolish to use them certainly for butter sent to Great Britain, which is the great butter market. Allow me to answer the question indirectly. Although the department during the last three years has been making these experimental exports to almost all parts of the world, yet in a great measure its attention has been given to the market of Great Britain. If there is one thing that has become apparent, it is that Great Britain is a great butter market, it is by far the best foreign outlet for our butter and cheese, and it is the British market that should be satisfied and cultivated. We do not need preservative in sending butter and cheese to England any more than does Denmark in catering to the same

trade. We can put our butter in the English market in as good a condition as the Danish and Swedish markets do. It is the pride and boast of Denmark and Sweden that they send butter to England free from preservatives, and that is one reason why Denmark stands at the head of British markets to-day, confidence in the character of the goods. The same is true of Canada. That is one of the reasons Canadian cheese stands at the head in the British markets, and why Canadian butter is getting ahead. The Canadian government stands behind and guarantees the butter and cheese which are exported to England. I believe our only hope for competing with Denmark and Canada is to take the same ground. Send an absolutely pure article, of high quality, free from preservatives of any kind. It is policy to do so. We should take pride in it and make a point of competing on this ground. This is reason enough why we should not use preservatives without discussing the question of whether it is harmful or not. If we do not need them why use them? We do not need butter color. When we send butter in the dead of winter to the southern markets we do not need butter color when they would rather have it without. It is exactly the same thing with preservatives.

Mrs. Ware. What kinds of packages are desirable in sending butter across the water?

Maj. Alvord. If the butter is good enough, it will sell itself in any sort of a package. The British market will buy good butter if put up in any package, without reference to style or character. Nevertheless, when entering a new market we are compelled to satisfy the tastes and preferences of that market.

In years past so much poor butter has gone to England in the tub form, what that market calls the Welsh tub, but what is the American creamery tub, that the appearance of that package, the tub, has come to be associated with poor butter; so that if you show them a tub of American butter, that is all they wish to know. So, in our experience, we found it advisable to seek for a package against which the English were not prejudiced. We tried the Australian cubical package, a square box holding a cubic foot of butter. We found a practical objection to that box, it did not strip well ; we could not turn the contents out easily. The almost universal practice in England is to turn the butter out of the package on to a marble or oak slab or table and to leave it free from all protection and without ice. Ice and refrigerators are unknown in the retail markets of Great Britain. Of course they want a package that the butter will slip out of easily. Then over there there is a universal demand for parchment linings for boxes. The cubical package was not easily emptied in that

way, sometimes it was nescessary to start the joints; consequently we adopted a little modification of the cubical package, tapering the sides slightly so the box was almost a cube but the bottom of the box was a half-inch narrower than the top, an inverted or truncated pyramid. This was lined with parchment. This we have been calling the "Wisconsin box" because, in connection with a manufacturing concern in Wisconsin, we gradually worked it out and made a package which satisfied our customers in Great Britain. This package is 12½ inches across the top, 11½ inches across the bottom and very nearly 12 inches deep, so that it holds just about a cubic foot of butter, weighing between 56 and 57 pounds. The English market holds to the old hundred weight as the basis of weight 112 pounds in the hundred-weight—and their butter is sold by the hundred weight. They want a package that contains either a half or a quarter of 112 pounds, hence the 28 pound or a quarter packages, or 56 pounds, or the half hundred-weight packages are the ones in favor in the British markets. I found that the safest plan was to start the package from this side containing butter weighing almost if not quite 57 pounds, and then I would probably only get credited for 56 pounds sold over there. If I tried to be smart and sharp and reduce my package to 56½ pounds on this side then it was two pounds short, they only paid for 55 pounds. We do not ordinarily divide the pound in wholesale business, but take the nearest whole pound below the actual weight. I instruct those packing butter for me to put in from 12 to 16 ounces over the 56 pounds, hence the shrinkage is such that I have a margin of a few ounces over the 56 pounds. This is rather a long explanatory answer to the question asked. The favorite package is a modified cube containing rather more than 56 pounds of butter when it starts.

Mr. Wallace. Is pasteurization desirable?

Maj. Alvord. I did not refer to pasteurization when speaking. I intended to be understood as saying that nothing but absolute cleanliness and cold are needed for preservatives. Perhaps pasteurizing might help for milk which needed it; this milk did not need pasteurizing. That would only be of particular advantage if the milk was poor stock with germs which would be likely to cause it to spoil within a short time. Pasteurizing or extreme heating I do not ordinarily advise. It is a way of covering up previous carelessness and is a premium, in my opinion, upon slovenly dairying. There is another objection to pasteurizing or sterilizing milk. These are only other terms for cooking milk and cooked milk is not as digestable as raw milk. Pasteurizing, which means heating to 150 or 160 degrees and sterilizing, coagulates the albumen

of the milk and renders a portion of the case in indigestable and makes it an objectionable article for some use.

Mrs. Ware. Should butter for Paris be sent in wood or in prints?

Maj. Alvord. In wood or stone or glass. Of course it would require greater care to move butter in printed or fancy form, but we desire to have as great a variety as possible to show what our home market demands; and we wish therefore to exhibit butter in small packages, in plain bricks, or in small printed packages. and we shall endeavor to move these packages, whatever the form may be. The Department will correspond with any one about making exhibits, and will make all necessary arrangements for the proper handling of the packages.

A Member. As to the butter shipped to England made from milk products by the common run of farmers; was this milk subject to any process before it was used?

Maj. Alvord. I cannot say either yes or no to this question, it requires a slight explanation. In studying the butter business, and especially the export butter business of Denmark, we found that more than ninety-five per cent. of the creameries of Denmark pasteurize their milk or cream and then use artificial ferments or starters to give flavor to it in making up the butter to export. The Dane gives two principal reasons for this; in the first place Denmark is the only spot on the globe that is more afflicted with bovine tuberculosis than any other. Cow consumption is so prevalent in Denmark that the law requires that all milk be pasteurized, consequently the creameries are obliged, by law, to do it. The other reason is the Danish people believe a more uniform article of butter can be made when the milk or cream has been pasteurized, that is the natural ferments killed and artificial fements added. They believe that by this process they can produce a more uniform article of butter than they can if they use the natural milk alone. So the question arose as to whether it would not be better for us to pasteurize the cream for the butter we were going to send—that is, send what may be called pasteurized butter, instead of what may be called raw butter. I did this during the entire season of 1898. I selected a large and carefully conducted creamery in Iowa to which the milk was brought from the farmers of the neighborhood, although I think we took pains to exclude the production of any farmers at all doubtful in the matter of the soundness or cleanliness of the milk. The milk of the community was brought to the factory and, after being thoroughly mixed, half of that milk was pasteurized, or the cream was pasteurized — sometimes we pasteurized the whole milk and sometimes the cream

and half left untreated; and then the butter was made from the two lots of milk, one part raw and the other part pasteurized. The butter was sent to England carefully marked and nobody knew until the returns came to my office, wihch was pasteurized and which was not. The goods were shipped via New York where two boxes of each lot were held back one from the pasteurized and the other from the raw cream. The butter itself was scored by an inspector before leaving the city. The butter was also inspected and scored upon arrival in England and the scores returned to me. The boxes retained in New York were kept side by side and scored every three or four weeks for, perhaps, six months. At the end of the season I made up my figures and compared them. I found that at certain times one was ahead and sometimes another; and they ended the season about on a level, nothing gained whatever by pasteurizing; only it had cost about three-fourths of a cent per pound more than the other butter. If milk is sound there is no need of pasteurizing it.

A Member. Can you tell what causes the variations in the Babcock test?

Maj. Alvord. I have not used the Babcock test for months, I do not see one used very often except as I go around among creameries. I do not want to answer the question.

Same Member. But you know there is a variation?

Maj. Alvord. Yes.

Mr. Wallace. Do you mean in the Babcock test or in the man who manipulates it?

Maj. Alvord. Both together. A good tester can do nothing with a poor testing machine, and the best implements are of no account if the tester does not know his business.

Mr. Higbee. Are there any that do?

Maj. Alvord. I think there are. I believe the Babcock test, the method of determining the per cent. of fat in the milk, is the great butter discovery of the century. I think it is fully equal in its importance to the cream separator. I do not see how one could get along without the other very well. It is not a thing to be played with any more than is the separator. It requires a machine that is right, and a man who knows how to use it. I think the Babcock apparatus is a very rough machine in the hands of a rough operator, but it is better than nothing in that line. It enables the farmer to study his herd and weed out his unprofitable cows in a way that never was possible before For this purpose it is not necessary to own an expensive machine or to be an expert operator. A two or three dollar machine in the hands of any man is quite sufficient for this work.

Mr. Stafford. Is the space system equitable? And wherein is the separator preferable to deep setting systems?

Maj. Alvord. I hope the gentleman does not want me to go back on myself. He has placed me in a very awkward position. I was responsible for the first half dozen creameries ever established in Vermont, on the space system, or deep setting plan. I believed in it twenty years ago and I believe in it yet largely and with some qualification. If the cows of the patrons of any one creamery are of the same class and alike in their method of handling, and if the feed of those cows is much alike I still hold that the space system is sufficiently equitable for all practicable purposes and I think there may be a reasonable doubt as to whether the creamery will gain any thing by making the change. Again, in a great many cases in New England a change from the deep setting space system to the separator system entails hauling the milk from the farms to the factory and the skim milk back again; hence I say the matter should be long deliberated and most carefully studied before the change is made. This burden of hauling the milk and skim milk is not half appreciated in the country. I have no doubt that a carefully operated separator will make more butter from the same quantity of milk than can be made from it if the milk is treated by the deep setting system. I think there may be a gain in the quality of the butter by getting the milk quickly under the control of the factory or the separator station. I do not think that is necessary, however. I believe it is just as easy with the same effort and the same care, to produce as good a quality of butter from the gathered cream system as from the separator and whole milk system. So I am not prepared to advocate the separator system as a substitute for deep setting and gathered cream system, especially in New England I believe the records show that there are creameries on the gathered cream plan here in Vermont that are doing just as well as those creameries which have adopted , what may be considered the latter, or separator system. It does not seem to be thus in the West. There the separator system seems to be ahead. I do not believe the fact that the butter from the separator factories ranks higher than the butter from the creameries conducted on the gathered cream plan. is necessarily due to the use of the separator.

A Member. Why not separate at home?

Maj. Alvord. That system is a modification brought about by the competition of the two older sytems. I was about to add as a conclusion that I believe the ideal creamery is the one which equips itself so as to handle milk or cream brought to it in any good, convenient way, cream which has been separated from its milk anywhere, in any way that its

owner desires, one paying for the cream according to its actual value. So I think the creamery of the future will not handle whole milk only or cream only, but one of the kind I have described, that takes its raw material in any form, provided it is good, leaving the producer to do about as he desires, to use the old shallow pan, a deep setting device, or a separation or to haul his milk to the factory. There is nothing to prevent the creamery being conducted on this elastic plan.

Maj. Alvord. Let me ask a question. Is there any factory here where the milk is hauled to the creamery?

Answer—I have one.

Question—Maj. Alvord—Who bears the expense of the hauling in both cases?

Answer—The farmer.

Question—Maj. Alvord—He hauls the cream as well as the milk?

Answer—Yes sir.

Question—Maj. Alvord—The factory has nothing to do with it?

Answer—No sir.

Question—Maj. Alvord—Have you made any figures on the cost?

Answer—He makes them, that is, if there are any made.

Maj. Alvord—I hope that the patrons will make the factories do it just as they used to do. I am opposed to the shifting of the cost of hauling from the factory to the milk producer. When this is done the factory prides itself upon the great reduction of running expenses, but nothing is said about the additional expense of the farmer, on account of the hauling. It is next to impossible to reduce this cost to dollars and cents, but I believe when the creamery undertakes to bear this expense, the cost of hauling is correctly ascertained and it worked down to the lowest possible limit. I believe this question of hauling all over the country, is the biggest leak in the system and one that must be settled; and I believe the business management of the creamery is in better shape to undertake this reform in most cases than is the individual farmer.

President Pierce. I dislike very much to break up this discussion but the time has arrived when we must take up the subject of private dairying. We have with us a woman who has, in all probability won more prizes than any dairy man in Vermont, I will introduce Mrs. Carrie J. Nelson, who will speak to us on "Private Dairying."

PRIVATE DAIRYING.

MRS. CARRIE J. NELSON, Ryegate, Vt.

Mr. President, Members of the Dairymen's Association, Butter and Cheese Makers' Association. Ladies and Gentlemen:

The subject allotted to me is in my line of business. The private dairy if rightly managed will make a product that will compare favorably with that of the creamery and will usually command as high a price in the market. I do not wish to be misunderstood as every private dairy is not rightly managed. Some are not particular enough in breeding; therefore their dairy is not up to the standard for gilt-edge butter. Others are not neat enough in their stables. If it is cleaned only once in twenty-four hours the cow cannot be otherwise than filthy and the milk from such a stable will be the same; but if the stable is cleaned, swept and the cows neatly bedded, there is less chance for taint in the milk. The quality of the butter is to some extent in the hands of the milker and feeder. The milker should thoroughly brush the udder before milking as any particle falling from the cow will taint the milk. We all know that some feeds hurt the quality of the butter. I will give you a little of my experience on this point. In August some five years ago or more my butter dealer wrote me two or three different weeks that the butter was off on flavor. The cows were at that time in a newly top dressed field and when that was close enough they were changed to the pasture and while there I took two first prizes on my butter; he also wrote that the butter was all right. During this time the corn was harvested and the grass ground top dressed in another large field, then the cows were turned into that piece. The next week he wrote the butter was off on flavor again. At that time I had never heard of top dressing affecting butter but could see no other cause for the sudden changes and since then have top dressed but little while the cows were in the fall feed.

At every dairy meeting I have attended since 1892 nearly all the speakers have advised using cotton seed meal, gluten meal, etc., to form a balanced ration for the cow. While attending the dairy conference at Portland, Me., in December, 1898, I was asked what grain I used to produce an average of 329 pounds to the cow. My reply was "corn meal and bran."

Some one in the audience spoke out and said, "If you had used cotton seed and gluten you would have made four hundred." I therefore decided to change the feed of my cows after the dairymen's association at St. Johnbsury. The changed ration made a larger flow of milk and we felt quite well satisfied with it. In a few weeks, however, the butter dealer wrote on the bottom of my weekly return "What are you doing to the butter? It is off on flavor." And so he continued writing March 2d, "Quality ought to be better." April 18th, "Butter is not as good as it ought to be." April 27th, "Butter is not up to the standard." About that time we wondered if it could possibly be the cotton seed and gluten and changed to the corn meal and bran. May 4th, the return read, "Happy to say the butter is all right." May 12th, "Butter is good enough." And for three weeks following it read, "Butter is good." From that time until now the cows have had no cotton seed or gluten, he has never mentioned any defect in the butter and that was all the change that was made. In private dairying we can control the feed while the creamery man has nothing to do with it.

I have not the experience in patronizing the creamery that most of you have for the milk from my herd has been sent to the creamery but four months and that in the fall of 1893. I have not the exact figures in my mind showing the difference in returns between home dairying and the creamery but it was over $1.00 a day on the amount of butter I was making at that time in favor of the private dairy. I was then using open pans and Prof. Hills said I was losing 0.98 per cent. of butter fat in the sample I sent to him at Burlington I called the skim milk better than an average sample. It takes about three hours to churn and to take care of a churning of butter when put into half pound prints. This comes twice a week in winter and three times in summer. Allowing a dollar a week for salt, wrappers, etc., it would leave six dollars for the work of churning balancing the cost of separating the milk and the use of the separators against the use of a team and a man's time going to the creamery seven days in the week.

The chances of a first class article are full greater in the home dairy than in creamery work; for we often hear the remark, "It does not make any difference as long as it is going to the creamery." If milk is only clean enough to be accepted is all that some care for. Others will say "What is the use of my being particular when the next patron's milk is any thing but clean? It all goes in together." I know several patrons of creameries who buy their butter for family use from a private dairy, because the private dairyman is more particular and does not save the milk from a fresh cow until it is fit

to drink instead of putting the second milking into the can as some do when sending their milk to the creamery. In warm weather milk frequently arrives at the creamery turned and so sour that it is not accepted and has to be carried home for feeding. In this there is quite a loss. I had some come back but once in the four months that I patronized the creamery, but that was during the last four months of the year when the weather was cool. I once heard the manager of Jersey Hill creamery say, in speaking of the way some patrons kept their cans on the outside, that he had to wear a glove or keep some waste in his hand there was so much filth on the bottom. If a creamery with the reputation of Jersey Hill has such patrons what might be expected of the common run.

I know but little of what my brother dairymen are doing but would like to ask every one who has sent his cream or milk to the creamery the past year and has averaged three hundred pounds to the cow to rise. That the audience may have a better idea how many have averaged 275 pounds per cow at the creamery.

From an average of thirty-four cows in my dairy the past year, allowing one cow for the milk and cream used in the family, eleven of them being two year old heifers, I have averaged 313¾ pounds of butter at an average price of twenty-one cents a pound net. Had it all been sold and I had bought the butter for the family use as the creamery patrons have to do it would have brought in $65.88 per cow. Every heifer was counted a cow as long as she gave milk and after if she was coming in again. If I thought I could do as well I might be induced to patronize the creamery, but there is one thing certain if I did I should lose the interest in dairying that I now have.

DISCUSSION.

President Pierce. Is your dairy chiefly winter or summer?

Mrs. Nelson. Mostly summer; I make about one-third as much in the winter as I do in the summer.

President Pierce. You consider that you can produce butter cheaper in the summer than you can in the winter?

Mrs. Nelson. Yes, because I do not feed much grain in the summer.

President Pierce. Do you feed much grain at any time?

Mrs. Nelson. My grain bill for the past year was just $15 to the cow.

A Member. I would like to ask the lady if she has ever tried feeding clear gluten?

Mrs. Nelson. I never have.

Question—What objection have you to the use of gluten?

Answer—It makes soft butter.

Question—Have you ever tried it in combination with feed?

Answer—No sir, I usually use corn meal and bran.

Question—Do you get a due proportion of protein in your combination of bran and corn meal?

Answer.—That I could not answer as well as some of you gentlemen could.

Question—Did you ever try peas?

Answer—No sir; and I have used cotton seed but once, I used it a good share of one winter when there was fault found with the butter.

Question—How much cotton seed did you use to the cow by weight?

Answer—I cannot answer that question but I think the cotton seed and gluten were mixed evenly together with bran, the cotton seed and gluten to take the place of the corn meal in a ration in which equal quantities of corn meal and bran were used.

Question—How much per cow?

Answer—About eight pounds of equal weight corn meal and bran.

President Pierce. What method did you use in the separation of the milk and cream?

Answer—I used the United States separator. I formerly used the large pans. I have had a separator about six years.

Question—Has there been an improvement in the quality since you used the separator?

Answer—I think so from the prizes that I have taken.

Question—Have you fed ensilage?

Answer—I have.

Gov. Hoard. How long since you commenced to use ensilage?

Answer—I think I have used it four or five years.

Question—Did you notice any difference in the churning of the cream after you commenced using ensilage?

Answer—I changed my churn at the same time I began to use ensilage and I could not tell you whether the difference was in the ensilage or the churn; but it took longer to churn after I used the ensilage.

President Pierce. How long did the cream ripen?

Answer—I intended to have it just acid.

Mrs. Ware. At what temperature?

Answer—Fifty-nine or sixty degrees.

Gov. Hoard. About how many hours of ripeness?

Answer—I churn about twice a week at this time of year. I keep it cool until about two days before I churn and then warm it up to about sixty and then keep it warm.

Question—How long does it take to churn?

Answer—It took fifty-five minutes the other day when we timed ourselves.

Question—Do you test your butter milk after your churn?

Answer—Not very often.

Mr. Sherburne. How cool do you keep the cream?

Answer—At forty-five perhaps.

Question—Why do you do that?

Answer—That the bacteria may not commence to work in it until I am ready for it.

Question—Can you make better butter in winter than in summer?

Answer -I think I make fully as good quality in winter as in summer. There are are some things against it in winter, but I have no refrigerator to keep my butter in in summer.

Question—Can't you keep it as cool as forty-five degrees?

Answer—I have no way of keeping it as cool as that.

Question—Did you ever think of keeping it warm in winter?

Answer—Yes I have tried it in that way. At one time I brought my butter to the Association meeting and the expert told me that my butter was a little too sour. It tasted to him as though it was too ripe, I told him my butter was ready to churn one day before it was churned. I have always thought since then it hurt it to be too ripe.

Gov. Hoard. I would like to add a word. I observe from the character of the remarks of this lady that she has the quality of teachableness. She has had her ear very close to the market. She has her ear constantly attuned to the verdict of facts and has no pre-conceived notions that she has carried into her business. I was very much struck with the concluding remark of her address, 313 pounds of butter to the cow, heifers and all! And was exceedingly surprised that there was not some man in this Vermont audience who would stand up and show himself, equal, at least to one woman in Vermont enterprise.

Mr. Northrup. Governor, if the lady had said "private dairying" I would have stood up.

Mr. Tinkham. Perhaps the Governor didn't understand that she asked the patrons of creameries who had made over 313 pounds to a cow to stand up. If you ask for private dairying you will find them all over the audience.

Gov. Hoard. I am surprised there are no patrons of creameries here who have not received for over 313 pounds to a cow.

Mrs. J. W. Thurber. How can they get it if they can't get it?

Gov. Hoard. I am surprised that any lady should ask "how can they get it?" in our country where ladies get whatever

they want. If the men who patronize the creameries in this state are not receiving what they should it is an argument against American citizenship. No creamery has any business to operate in any state that allows it to handle the product without every patron knowing what they are about. In my own state it would not be suffered. In my own county there are 103 creameries. There are, I presume, one hundred or more herds that constitute that patronage that make over 300 pounds per cow. The Babcock test and the skill and intelligence of the patrons are factors which are brought to bear upon the business; and if business is conducted in Vermont under any other or different system it is time there was a change.

Mr. Tinkham. I have the figures of a creamery near where I live—though I do not know how correct they are—showing the excellent results of creamery management during the three years of operation. They had bought a new engine, made all their repairs, paid their salaries, expenses, etc., and had $2,000 surplus. This came from the farmers, of course. It seems to me that tells the story very plainly, Mrs. Nelson gets six dollars for churning and making her butter, over what she would get if she carried milk to the creamery, I do not see why the ordinary farmer cannot as well make his own butter as to pay some one else to do it. For that reason I have never patronized a creamery. I made the statement in one Association meeting that every farmer had it in his power to make better butter than any creamery could make, that the farmer from the very ground up has the matter in his own hand—the selection of the cow, the selection of the food the handling of the milk. Within twenty-four hours I visited a dairy, the owner of which also ran a creamery. I went into his barn where there were thirty cows standing. There was no drop behind the cows, there was not the remotest sign of there having been any bedding there for thirty years. The flanks of the cows were reaking with filth and in places behind them the droppings were piled just as sharply as they could be without slipping down into the gutter; and that man was running a creamery. When I got there he was just out milking. His receiving pails stood right there on a shelf and he would milk from a cow and pour it into the cans. He probably succeeded in running a creamery and I guess he got full as good results from his milk as he would if he had not reduced it with other milk.

A great cheese maker was asked by a man to come over and see his cheese. He went over and looked at the cheese and smelled of it and rubbed some between his thumb and finger and smelled of it and the man said "Mr.— what is the matter

with my cheese?" and he said "If you will mix a little more milk with your manure I think it will improve it."

C. J. Bell. I have enjoyed the remarks on home making of butter, yet on the other hand I am surprised not to hear some words spoken in favor of the creamery. There is, sometimes, good butter made in the creamery, butter that sells for a good price. There are from 200 to 250 creameries and cheese factories in Vermont, they are fairly well patronized and make from 20,000 to 25,000 pounds of butter per day.

Mr. Stafford. I am loath to believe that all the good butter that comes out of Vermont is made in private dairies. The quotations of butter are higher on creamery than on dairy butter. If the creamery was the cause of the man's filth in the case cited it would have looked after it. If that filth exists the creamery is not to blame but the dairyman.

Mr. Tinkham. I did not attribute his filth to the creamery; I only gave as an illustration of what some men will do.

Gov. Hoard. Do you think the man would have made better butter in a private dairy?

Mr. Tinkham. Creameries are an advantage to the state, but I want to emphasize the fact that every family can make as good butter as any creamery can. Seventy-five per cent. of the dairymen might improve their butter by going to the creamery, this man undoubtedly belonged to the seventy-five per cent.

Gov. Hoard. This debate is taking a wholesome turn and bringing the question back to the individual responsibility of the men who produce the milk. The farmer is the man who produces the butter, the creamery does not do it; the creamery simply separates that which is given to it.

The Hoard creameries in Wisconsin have to make butter for private demand and they have from five to seven thousand families to supply with butter every week in Pittsburg, St. Louis and Chicago. There has to be exceeding care taken with that butter, from the farms that produces it until it is placed in the hands of the consumer. We found that the hired girl way down in St. Louis was injuring the reputation of Hoard's creamery. And so a circular was issued to the housekeeper asking her not to put the butter when it came to her home in the refrigerator with the cabbage, etc., and so the house-keeper woke up to the fact that she was responsible in some measure. The eight hundred farmers who supply the milk also have to be looked after every week and a superintendent was hired who does nothing but go around from one creamery to another and from one farm to another. At the creamery the milk is sampled and if anything is the mat-

ter with it the superintendent goes to the farmer and says "there is something wrong with your milk."

Mr. Walker. I think the distrust that exists between the patron and creamery man is mainly due to doubt as to the correctness of payment for butter made. The patrons find fault and say they are not paid for the butter their cream makes. A bill was introduced into the Legislature of Vermont in 1896 providing that there should be a public tester who should visit creameries without previous notice and test the cream and milk of the patrons comparing this result with that made by the creamery. It was recommended by the Board of Agriculture and it was passed in the House. Creameries should be run so that the books should all be open. If they pay on the Babcock test, the patrons should know how much butter they are receiving for, if this was done harmony might prevail.

Mr. Adams. I want to relate a little experience of my own. Four years ago in Derby, where I live there was a private creamery and this same distrust was manifest. The patrons said "we won't carry our milk any longer to this man, we are not satisfied, we will make our own butter, we will organize a co-operative creamery." They have been running that creamery as a co-operative creamery for four years. We use the Babcock test, everything is open and above board and our patrons understand that they may know everything about the creamery as well as the stockholders that there is nothing covered up. I think it is one of the most satisfactory creameries in the State of Vermont. Men who were making butter that was not salable are bringing their milk to this creamery and we are handing out to patrons something like thirty or thirty-five thousand dollars a year. I have had experience in private dairying and there is not a business in the State of Vermont that I like better than to make my own butter if I could do it; but circumstances have compelled me to patronize this creamery and I am probably doing as well as I could do anywhere. If there is a person who can make his own butter we will uphold him in it; but there are circumstances that compel a man to go into creameries. If you have creameries you are suspicious of, get rid of those suspicions some way and have everything done openly and above board.

Gov. Hoard. You have touched upon the question I had in mind, this distrust. There is a simple way for a square man to deal with that question of distrust. But let me say you to that ignorance is often at the bottom of distrust, the farmer does not understand the facts of the case and he is suspicious because he does not understand. It is the duty of the creamery to have matters so the farmer will understand. There are farmers who do not understand the Babcock test and are

suspicious of it, but any creamery man who has a distrusting patron can obviate that distrust if he has a mind to. Let duplicate tests be made. We offer to every farmer who distrusts or is suspicious a duplicate test, the test is made and if they shall agree we assume the test has been right, and in some cases we have had quadruple tests made. It is easy to do this, and there is a disposition on both sides to come together and do justice to one another.

Mr. Holt. Will Mr. Adams state whether since organizing this cooperate creamery they have been able to get the same per cent. of butter from the creamery as they did at home with their own churns.

Mr. Adams. I think there is a misunderstanding sometimes in regard to this matter when patrons are paid by the Babcock test. Until the present year the patrons of Vermont creameries have been paid upon the butter fat. Many fall into error through ignorance. The Legislature of 1898 passed a law providing that all products of the creamery should be paid for on the basis of actual butter. We have a patron of our creamery who said to our butter maker a few weeks ago, "Is not butter doing better this year than it was last? Yet I am getting but little more than I did last year?" He was told that "last year we paid on the butter fat, this year on the number of pounds of butter, hence the misunderstanding."

Mr. Holt. We understand we are paid on a very low scale of prices if paid on the actual amount of butter.

Gov. Hoard. Are you not paid the market price?

Mr. Holt. Yes sir, but we do not get credit for as much butter as we are able to get at home.

Gov. Hoard. What is the price?

Mr. Holt. I could not tell you at the present time, but I had this experience with the creamery. I took twenty gallon of cream, mixed it thoroughly and sent one-half to the creamery and churned the other half at home. I gained one pound in six at home from what they got at the creamery, I think Mr. Walker as well as others have had the same experience at the same creamery.

Gov. Hoard. If your cream at the creamery was adjudicated upon the Babcock test you got so many pounds of butter fat and not butter; butter usually runs one-sixth more than butter fat.

Mr. Holt. We know what we got paid for.

Gov. Hoard. Seems to me your creamery should have some standard to go by.

Mr. Wallace. I think Vermont is unfortunate in some respects. If we had men like Gov. Hoard to run our creameries we should be safe, but we have not. We became distrustful of

our proprietary creamery about three years ago. The farmers put their heads together, put up a building and the machinery into it and now make their own butter. The creamery patronage has increased from nineteen to seventy-five. The butter is made at a cost of from 2¼ to 2½ cents while nearly all the other creameries are charging three cents for making the butter. It seems to me if the farmers would combine, take matters into their own hands and do their own business, then there would be none of this fault found. Establish an open way for running your business, have your books open at least once a year, have auditors to go over the books, have a board of directors to work in connection with the management of the creamery. If any patron is dissatisfied ask him to come to the books and look the matter over. We find in our valley that this method has been successful and at the present time we are putting in a new skimming station, and probably by another summer our patrons will number 125.

Mr. Holt. I would ask Gov. Hoard, if it is not probable that cream carried to our creameries which has been kept under different conditions, at different temperatures gathered only twice a week, churned quickly after being received at the creamery, if it is not probable that a large per cent of the fat would be lost in the buttermilk being unchurnable because of the different conditions in which it is received, hence causing a loss as compared with home churning?

Gov. Hoard. That would depend upon the skill of the butter maker. Skill tells on the farm; tells everywhere. Honesty also tells everywhere, and a dishonest creamery is a stench in the nostrils of a large number of patrons. Dishonesty is a factor that comes into the cooperative as well as into the proprietory creamery. Only a few days ago I saw a cooperative manager driven out because he had been selling butter without the knowledge of his patrons. But, answering the question, it depends upon the skill of the butter maker. If a skillful operator takes cream from every direction and in almost any condition he may churn it to its lowest equation; if unskillful he is less likely to do this. But one point more, and that is the lesson. Every creamery and every individual farmer should be intelligent. There is no excuse in this day and generation for lack of intelilgence on this question. A community of intelligent patrons can invariably have an honest creamery. The management cannot get away from it. Intelligence among the patrons will force it to be honest and square and skillful.

Adjourned.

Wednesday Morning.

President Pierce. We have allowed the speaker to change his subject and he will speak on:

"SOME DAIRY HINTS GATHERED FROM MY EXPERIENCE."

H. W. VAIL, North Pomfret, Vt.

In preparing this paper I thought it would be of interest to me and probably to other dairymen to know how large a portion of the butter of the state was made in creameries and how much in private dairies; whether the amount of butter made in creameries is on the increase from year to year; and to be able to get the true trend of our dairy situation ; but no such data can at present be obtained. The only data touching the dairy interest of the state I have been able to find is contained in the last report of the Board of Agriculture compiled by Mr. V. I. Spear (1898) in which it appears that the number of cows in the state has decreased in the seven years following the census of 1880 to the extent of 10,763, and young neat stock, 48,060, or about 8,400 head a year for the seven years, a yearly decrease of about four and one-half per cent. of the whole number of cows. This would not indicate that the amount of butter annually made in the state was on the increase although I am satisfied that more butter is made from each dairy cow on the average than formerly.

It is evident, however that a large portion of the butter of the state is now made of at creameries and in passing I would call attention to the rapidity with which the creamery has occupied the dairy field. Twenty-five years will nearly cover the growth of the whole system and along with this growth or possibly preceding it a little, have come all the present dairy machinery and appliances and the application of power with separator and Babcock tester. This growth has developed along lines of much usefulness and has been the great factor in raising the average quality of Vermont butter. While no inventions have appeared within the past few years to make material change in the present system it in not improbable that sooner or later they will come. For instance in

the milk gathering system one of the heaviest items is the cost of making the butter is the carriage of the milk and skimmilk. About eighty-seven per cent. of this transported matter is water and only four or five per cent. of the whole amount is taken at the creamery. The labor expended in transporting this water to and from the creameries is something enormous and ought to be better employed. It will be a great day for creameries when science points out some practicable, economical and profitable use for skimmilk at the creameries. It seems useless today for science to tell us that the four or five per cent. taken out of the milk at the creamery was that portion of the solids of the least value as human food and that the curds carried back and thrown to the swine is rich in nutrition in its most digestable form. The demonstration made by Edward Atkinson and others that cheese made from skimmilk when cooked makes a very palatable, economical and wholesome food, seems to make but little headway in overcoming the well earned prejudice against skimmilk cheese; but I am looking for light along this line of skimmilk that will work changes in our present dairy system.

It has been published with more or less authority from creamery sources that herds of cows giving about four per cent. fat in their milk were the most profitable cows for creamery work. This statement was made before one of the meetings of this association by a man having an extensive creamery experience. This statement, if true, seemed to me very important because if the four per cent. cow is the most profitable animal for the creamery she should also be the best cow for private butter making. If the statement is correct as a rule then as the per cent of butter fat recedes from four per cent each way a cow or herd of cows would become the less profitable. I applied this rule to my own herd using the Babcock test on composite samples and weighing the milk at intervals. I found my most profitable cows giving six per cent. I overhauled the records of the experiment station and of the Chicago test and as a class the high per cent. cows appear to have the advantage. I discover no particular relation between the amount of milk a cow gives and her per cent of butter fat. Contrary to the quite common opinion that a cow giving a small amount of milk is rich in butter fat it may be the reverse and a cow giving a large flow yields a much higher per cent. of fat in her milk. From the data at hand it appears that the cows giving the higher per cent. of butter fat produces butter as a rule at a less cost per pound than the cows giving the low per cent. The difference between six per cent milk and three per cent. is a difference of one hundred per cent. requiring twice the amount of milk to produce a pound of butter conse-

quently nearly twice the amount of curds which calls for the extra protein, the costly factor in animal food.

I am satisfied that I cannot afford to keep a cow in my dairy which does not give over four per cent. fat.

Incidentally there has appeared an item of interest to those making a study of the transmission of the qualities of ancestors to their offspring. Prof. Cooke called attention sometime since to the strong tendency of a heifer to give the same per cent. of butter fat in her milk as was shown in that of her dam and I now note the same tendency in my own herd and while we have not data enough to proclaim a rule that the butter fat of a heifer's milk will be the same as that of her dam yet I have found no other characteristic transmitted with greater uniformity.

As a rule I practice private dairying and make up my own butter because I can get a little out of my dairy in this way. Yet I have sometimes found it profitable to patronize a creamery and I was glad that creameries were within reach to take my milk or cream, and I have this to say to all patrons of creameries; if you feel that your test is too low, do not grumble at your creamery man about it, he is probably honest, but get a Babcock tester, have one in every neighborhood with the apparatus approved by our experiment station and have someone skilled in taking samples and using the test and know what your herd should test. It is about as easy to know the amount of butter fat in your milk as it is to know if you get correct weights from your butcher or grocery man and when this practice becomes general with the patrons of the creameries there will be no monkeying with the test and the little errors likely to arise will be harmoniously adjusted.

I feel more and more the importance of every dairyman's knowing the per cent. of butter fat of each of his individual cows. This has assumed a more practical form since we have learned that the per cent. of butter fat is a fixed individual trait and is not affected by feed.

The common ground for economical and successful dairy work for both the private dairy and the creamery patron is the good cow with good feed and good care. There is a whole sermon along this line of thought in the famous experiment of the Kansas experiment station with the scurb herd. This herd was purchased without an attempt at selection, hoping to get as poor cows as the poorest farmer had to deal with. They were placed under high feed and the best of care.

The best cow made 451 pounds of butter worth $73.17, less cost of feed, $40.37; the poorest cow made 157 pounds of butter worth $26.22, less cost of feed, loss, $0.43. The tabulated record of the herd at our own experiment station for the year

1898 shows a range in value of cows fully as marked, the best cows producing a pound of butter at the cost of ten cents per pound and the poorest at a cost of thirty-eight cents. These figures indicate the actual difference in cows under the same high feed and good care. With the manufacturer of dry goods the cost of producing a yard of cloth is the determining factor in the question of his profit or loss, similarly the cost of producing a pound of butter is the determining factor in the profit or loss of the dairy man. These carefully made experiments reported from these stations furnish further proof, if any were needed, that there is a fixed organic difference in dairy cows and that they vary in their usefulness from those that yield a handsome profit down to those that are being worked at an actual loss to their owners. I know of no better way to determine the value of our cows than the weight of the milk and the Babcock test.

President Pierce. This subject certainly is one of interest to every private dairyman as well as the creamery man. We will take up the discussion at this time and I will call upon Mr. George C. Wright of Westminister, a practical dairyman to open the discussion.

Mr. Wright. My efforts have been largely along the line of private dairying rather than creamery work, Mr. Vail's ideas apply as well to one as to the other. The past year has presented to the dairymen of Vermont, more strongly than for a great many years, the advantages of private dairying. There is hardly a town in the state of Vermont that has been able to get as much dairy butter as was desired; and the price of the strictly first class article has gone up to the top in a great many instances. I do not mean the trade considers the dairy butter as favorably as this, but the field for the dairyman is not so much along the line of trade, as in his own individual effort. And where a man has taken hold of this matter right he has been successful all along the line. He has had to meet the competition of the creamery trade and this past year there has come back to him a share of the advantages and some of the gain which he has all the time felt was his due, provided, he is a skilful private dairyman. I want to point out to you an example of private dairying which may not be familiar to you all. It is a gentleman who has been engaged in the business for twenty years and has kept abreast of the times. He has held the trade in Brattleboro which he had when he started in, and his butter has been sold in this market in competition with creamery butter, for thirty cents a pound the year round. That is an extreme case, but it shows what can be done in private dairying if a man is adapted to his business, and is well equipped he will get better results if

he attends strictly to his own business and makes his own butter than if he patronizes a creamery.

Mr. Gale. I understood Mr. Vail to say that the per cent. of butter fat in milk is uniform, is not affected by feeding. Do I understand by that that we can feed for milk only, and such foods as will keep up the physical condition of the cow and let her take care of the butter fat?

Mr. Vail. This touches the old question which has been in dispute between the scientific men and the dairymen. I think there is no question but what we should feed for milk, and that the butter fat is a fixed thing with the cow. If a man goes to the station and sees the care with which the experiments are tried there they will understand that the ordinary man, however careful, with the conditions surrounding him, cannot make such thorough tests; and the Experiment Stations in this country and every other country are united in the statement that a cow's butter fat is practically a permanent thing, no matter what you feed her. You can test a cow today and test her tomorrow and she may give a different per cent. but test week in and week out and you will get a fairly uniform per cent. of butter fat. If you doubt that, study the frequent tests made at our own station, they show fluctuations from day to day but at the end of the year the cow has not varied much of any. There her per cent. is and there it stays with that cow. Her milk may grow a little richer as the heifer becomes a cow, but it stays with the cow, a quality given her by heredity and it stays with her as long as she gives milk, barring of course abnormal conditions, such as sickness or starvation.

Mr. Messer. I used to think that food was quite an important factor in the quality of milk, but I have come to a different conclusion. I remember seeing not long ago the result of an experiment made at the Geneva, New York, station which many of you doubtless saw. A certain cow was subject to experiment to ascertain the amount of butter fat which the cow gave under normal conditions. Then for a greater or less time she was given a food from which the fat was almost entirely extracted, so that she was fed but six pounds of fat in the food given her for many weeks. The food was subjected to extraction with naptha so as to eliminate nearly all the fat. But there was no difference in the amount of butter fat which that cow produced. She placed over ten times as much fatin her milk as she ate in her food and she likewise fatted up bodily. This seems to me evidence that the butter fat in a cow does not result from the fat of the food that was given her at any time, and while I had enough evidence before this, this ex-

periment seemed to clinch the fact that the cow provides the butter fat in some way that we do not know about.

A Member—My experience would confirm what has been said about the relation of breeding to butter fat, but I think there is the possibility that extra feeding and better care, may change the character of the daughter's milk from what the dam gave. And I think that the environment of the cow which may effect the butter fat. This fall during the cold time I was not getting as much butter from the same quantity of milk as I am at the present time, and yet I was feeding my cows as well as ever; and I thought that perhaps the cold winds of the fall had an effect upon them temporarily; not to affect the general amount of butter fat, but to affect them temporarily. I would certainly emphasize the idea as to the relative economy of the higher testing cows. I believe it costs as much to manufacture the cheap milk as the high testing milk; and that herds which test five or five and one-half per cent. are more economical as butter makers than herds that test under five. My own herd is taking only about 13.57 pounds of milk to make a pound of butter, but it took about sixteen for a while from the middle part of October. As a general thing I have run from fourteen to fifteen, I believe these cows are more economical butter makers than other cows where it takes twenty pounds of milk for a pound of butter. My practice has been to breed for a high per cent. of butter fat and for a good flow as well.

President Pierce. Which cow produces the most butter, the cow which tests five per cent. of butter fat or less?

Mr. Vail. I think the cows which have produced the most butter in my herd have been cows testing from five and one-half to six per cent.

President Pierce. High test cows are not always the largest producers. I have one or two cows that will test seven per cent. but I do not think they make as much butter as those which test five and one-half or six per cent.

Mr. Higbee. Benefit may be gotton out of this discussion through mutual exchange of opinions. In regard to matters of test and the butter making qualities of different cows I would say that I do the figuring for our creamery and handle the funds. The lowest testing herds, in many cases, give the largest quantity of milk. I used to think everything depended upon the high test but I have changed my mind in regard to the matter since some of the best paying dairies are made up of low test cows. Some of our patrons grumble and cannot understand why it is so; it is because they get a larger flow of milk. When you get to the bottom of facts it is the money you are after; the dollars are the confirmation. Some

of our patrons think they are ill-treated by the test, but in my judgement the average creamery man is as honest as the average business man in any other vocation. We test four times a month. One of our patrons sent up his milk to the Experiment station and he thought he would catch us napping, because the test would be different. This might result in agreement or in disagreement of tests. It depends altogether how carefully the sample is taken whether the result will be correct or otherwise, if the sample is taken from the first milk ing or the strippings of the cow results will be erroneous. To check the accuracy of creamery testing by the station analysis you must use the identical sample. Our creamery man will let any patron take his sample and seal it up and send it to the Experiment Station. But if the Station is going to make our butter maker or our directors responsible for stealing we want it to test the same sample we use and we will not submit to anything else. We want the same thing tested. Let the creamery man take the same sample out of the composite can and then we will stand our end with the Experiment Station. We take it for granted the man at the Experiment Station can test the milk.

President Pierce. I would ask Prof. Hills whether the high testing or the medium testing cow has proven the most economical butter maker at the station?

Prof. Hills. The station owned a dairy herd for over eleven years. It has been under experiment all the time and has been handled in many ways. Our work has been sufficiently extensive and conducted with such care that we are better able to judge this matter than most people. As a broad and general rule the cows making relatively rich milk upward of five per cent. have made a pound of butter at a lower cost than those which have tested below four and one-half percent. Our Ayrshires make the cheapest milk but they seldom make the cheapest butter. Our registered and high grade Jerseys make as a rule a more costly milk but cheaper butter than the Ayrshires. There is, in my judgment, a third item which every man must needs have if he wishes to get a fair idea of his herd. You need to know, in a rough way the amount of food eaten. Mr. Vail correctly stated that the cow giving 6000 pounds of three per cent. milk will usually make a pound of butter at a greater cost than the cow giving 3000 pounds of six per cent. milk, since the caseine contents of the former is much larger than of the latter, and that is made from the most costly constitnts of the food. Experience and practice agree in saying that as a broad and general rule the cows that give the richest milk — provided the flow is a reasonable one — are the cows which make the cheapest butter. In reference

to the statement of Mr. Higbee to the effect that "if the station is going to make our butter maker or our directors responsible for stealing we want it to test the sample we used and we will not submit to anything else," I would say that under the law the station has not much discretion in the matter. The Experiment Station is by law required to analyze agricultural materials sent to it by citizens of the state. If a sample of milk is sent, we do not conceive it our duty to refuse it lest it be improperly taken. In reporting results, however, we are careful to disclaim all responsibility as to the correctness of the sample and at the same time to say that unless it was correctly taken the results mean nothing. We send with each report of milk analysis a little four page bulletin which we think describes in a plain way the correct methods of sampling milk. Mr. Higbee states that to insure certainty as to the validity of comparative tests at creamery and Experiment Station the same sample needs must be tested at each place. In my judgement there is absolutely no way in which correct results may be inevitably attained. What will it avail halving a creamery sample which has been in the hands of the creamery man who may have tampered with it? If the creamery for any reason is afraid of the station's tests the sample may be readily manipulated by the interested party —the managemeut. On the other hand if the patron takes his sample for himself or has the creamery operator take duplicate samples, one to be held by him, the other by the management, the sample for the station is in the hands of the other interested party, the patron. Experience indicates that he is quite as likely to affect his sample, either through ignorance or intent as is the creamery man. If either side is ill-informed as to sampling methods or is inclined to be tricky, no method of sampling will insure justice. The station analysis is, however just to those parties who are honest, candid and intelligent.

Mr. Vail. The point which I brought out in my paper and which drew out this discussion upon the relation of quality of milk to profit was the claim that creamery patrons find four per cent. milk the most profitable. My experience with the private dairy was quite different. Can you tell us why this is? From creamery sources one statement from the Experiment Station and from the individual dairy the opposite?

Prof. Hills. I cannot answer that question. The burden of proof rests upon the creamery men and they should elucidate that point.

Mr. Aitkin. Careful investigation indicates that the rich milking cow is the most profitable, yet the creamery men say the cow testing the lower per cent. is the more profitable. Is

not it true that farmers do not know how much it costs them to produce the large amount of milk?

Mr. Higbee. One of our highest testing butter cows is the high grade Jersey, but the man who has her does not get any where near as much money as the other man who has grade Durhams and Holsteins. I do not know as either of them has figured out the entire cost, but I do know the man with the large cows gets the most money; and when he turns his cattle into beef he gets more money; and he gets more money all the time. When he turns off the veal calves they weigh something, whereas some of the rest weigh just about as much as a barn rat. Now this man I do not suppose worries very much about how much his feed costs him; he has got enough money in his pocket.

A Member—Is not the high testor likely to give a relatively small amount of milk?

Mr. Vail. As a rule.

A Member—Let one young man start out at twenty-one years of age with ten good cows and let another with ten poor cows, in twenty years one will have succeeded and the other have failed. I am running a private dairy with good success. There is generally from three to five cents difference between the dairy and creamery butter in the local and city market. I could not agree with the gentleman in my experience with the low testing milk.

As to private dairying and securing customers, I would say that it is very common for people to claim they cannot sell butter if they make it. If they are not good sellers the next best thing must be the creamery; but any one blessed with reasonable talent has a fair chance in a local market. When I started in anew in 1898 to hunt up customers I found difficulty in getting a standing. Those whom I importuned said we have tried dairy butter, tried it quite a good deal" and they would hardly listen to me, one has to have a good deal of courage not to get down hearted. I made something like 2809 pounds from nine cows in 1898. Last year I did not do as well; but after getting a little started I have had no trouble in selling the goods. I believe that the poor butter of private dairying is damaged mainly between the skimming and the churning. I believe there is no better time for the separation of the milk than when it comes from the cow, and that if the private dairyman will take pains there is no reason why it should not be better than other butter. It requires however, some interest and insight and knowledge.

A Member—I want to ask Prof. Hills if he takes the same sample of milk, he can by the way he manipulates the test, make it vary?

Prof. Hills. If the man who operates the Babcock test is ill informed, if he deliberately mismanages it or his apparatus is faulty, erronous results will be obtained. The same person handling the same sample, if competent, honest and possessing good apparatus should not make any material difference in the result, by repeated trials. This whole matter will be discussed to-morrow morning in my address to the Association.

President Pierce. Vermont has not a wide reputation in regard to cheese yet we believe this industry should be encouraged; and those who are working along this line we believe should have all the help possible.

It gives me great pleasure to introduce to you Prof. H. H. Dean who will now speak to you:

"THE CHEESE INDUSTRY OF CANADA AND HOW IT ATTAINED ITS PRESENT POSITION."

H. H. Dean, B. S. A., Guelph, Canada,
Professor of Dairy Husbandry.

Mr. President, Ladies and Gentlemen:

There was a time when Canadians used to tremble every time the American Eagle screamed. We do so no longer. We have come to regard you as friends. I have come to pay you a friendly visit, and I trust our visit and talk together to-day shall be one of mutual profit. Our exports in butter are some four or five millions of dollars per year, while our exports of cheese run from seventeen to eighteen millions of dollars per year. So you see we are very much interested in cheese making, while I judge from the remarks here today your interests in dairying are more along the lines of butter making.

The cheese industry of Canada is the result of naturally favorable conditions, and is a reflection of the tastes and aptitudes of the Canadian people.

The Province of Ontario, from which I come, is surrounded by the great lakes ; and we have inland rivers supplying the moisture which is necessary for skillful making. The Province of Quebec and the maritime provinces too are largely engaged in cheese making.

Our people are descended from the best cheese makers of the old country—Scotch, English, German, Dutch and French—a great many of whom brought with them this natural taste for cheese making. As a consequence, our people have developed cheese making to a very large extent indeed. The cheese industry in Canada is of recent growth. The first cheese factory in the Province of Ontario was built in 1864, and the industry has spread until now it covers the whole of the Dominion of Canada.

People have an idea that Canada is a little frozen up place, noted only for its cheese-makers and icicles. You will perhaps be surprised when I tell you that our country is larger in extent than the United States, although we have not its population. But that is growing, and the time may come when we shall have as large a population as you have, and then, perhaps, will come the time when private dairying will have reached that point which it has reached in this state.

Your many manufacturing towns make a market for your private dairy which we have not got in Canada. Our market we most often find out of our own country ; therefore we find it pays us best to manufacture cheese, although our butter industry is growing rapidly. At the present time cheese is worth twelve cents per pound, and with us, with cheese at ten to twelve cents per pound, the cheese factories can pay their patrons more than the creameries can; hence our creameries during the past season have had a hard struggle in keeping up the supply of milk in competition with the cheese factories.

Perhaps it would not be out of place for me to make a comparison between the exports of cheese from Canada and the United States. I am aware we have a proverb about comparison, but you will pardon me if I do make one. In 1870 the United States exported sixty millions pounds of cheese; Canada but six millions. In 1880 the United States exported one hundred and twenty-seven and one-half millions of pounds, Canada forty millions. In 1890 the United States exported ninety-five millions of pounds while Canada exported ninety-four millions, practically the same from each source. In 1895 the exports of cheese from the United States had dropped to sixty and one-half millions of pounds, while Canada exported one hundred and forty-six millions of pounds of cheese. In 1898 the United States exported but forty-six millions of pounds of cheese, dropping from one hundred and twenty-seven and one-half millions in 1880 to forty-six milions of pounds in 1898. Our exports for 1898 were one hundred and fifty millions of pounds, and for 1899 they will be larger still; and too the prices being much higher in 1899 than in 1898, our people received in the neighborhood of $18,000,000.

I hope you will not think I am vain in making these comparisons. I wish to draw your attention to the fact that since 1870 the exports of cheese from the United States have been gradually decreasing and the exports from Canada gradually increasing, and the question arises, why is this thusly? You can, for yourselves, answer this better than I can. Looking at it as a neighbor I would say there are two main reasons why your exports have dropped off. You have had a rapidly increasing demand at home which has consumed your manufactured cheese to a large extent. But the main reason your exports have dropped off is that you have been making two classes of inferior cheese. I cannot say whether this is true of Vermont or not, but it is true of the United States. You have made two classes of cheese which has injured your reputation in the British markets. You make a skimmed milk cheese and a filled cheese. The Englishman is particular what he eats, and if he gets the idea that the food products

supplied to him are not what they are represented to be, he will look for his goods in some other direction. What has been to your disadvantage has been to our advantage. Our government has passed laws forbidding the manufacture or sale of skim or filled cheese and we know nothing about those articles except what we learn from the papers. We are willing you should manufacture here all the skim or filled cheese.

Our factories have gained in number until we have somewhere in the neighborhood of three thousand cheese factories. I would they were smaller in number because it is a disadvantage to have too many small factories. I would much prefer that we had fewer factories, larger, better equipped and better manned; and in our best cheese sections, where the finest quality is produced at the lowest cost, we have the largest factories with the latest and best machinery. The smaller the factory, the poorer the equipment, the greater likelihood that there is a poor cheese maker in charge, and that the quality of the product will deteriorate.

A very important factor in the development of the cheese industry in Canada has been the work which has been done by our dairy associations. We have in my own province two associations. The Western Butter and Cheese Association, and the Eastern Butter and Cheese Association; and our cheese and butter makers have also formed an association. The Province of Quebec and the other Provinces also have similar associations. These associations have sent out inspectors or instructors to the factories and given the makers in charge the latest and best information, in order that all makers should adopt as nearly as possible uniform methods. In working up export trade for food articles, one of the most important points is to have the goods uniform; and while every maker has differences in detail, the object of the associations which are at work to better the cheese industry has been uniformity, and that can only be obtained by having the makers attend dairy schools or receive instructions from competent men at the factories. We have found the factory inspector and instructor's system one of the most important factors promoting this uniformity. There is a little rivalry between the different parts of Canada, but the thing we have aimed at has been to make Canadian cheese of uniformly good quality. These instructors have other work. We have a few dishonest people in Canada and I would judge, by a few remarks dropped here, there has been some suspicion as to the correctness of tests in Vermont. Some Canadians milk the pump, as well as the cow, or skim the milk to some extent, thus getting an unfair advantage over honest patrons. A part of the inspector's work is to examine the milk at the fac-

tories and if below normal they prosecute the owners. I hope the day will come when all the milk will be paid for according to its cheese producing value, instead of according to the weight delivered.

We have three systems in Canada of dividing the proceeds among the cheese factory patrons. First the pooling system, dividing money according to weights of milk delivered; second, according to the weight of fat delivered; third, according to the per cent. of fat plus two, the added two representing the caseine or cheese producing constituent of the milk. The larger proportion of our factories, however, still divide the money according to the weight of the milk delivered.

I have little or no sympathy with the majority of patrons who complain that some patrons will water the milk, because the former have it in their power to enforce the adoption of a system which will be practically just to all concerned, the system of testing and dividing according to the test. This method of payment is very slowly gaining ground, however, as all these things take time; and I have no doubt sometime in the future the milk will all be tested which goes to the factory, and the proceeds divided upon some correct and just basis.

While we have not adopted any systems of direct bonuses, the governments encourage the cheese industry in every way possible. We have been able to do this by spreading information among the people and by helping secure the market. The passage of the McKinley bill a few years ago has redounded to our advantage. Many of our people thought the American market lost to us; but instead of harming us it was, in very many cases beneficial to us, because our people went to the old country and worked up the markets there. Our government provided transportation, until at the present time we have a market which for the whole of Canada is more valuable than that of the United States could have been. We are always willing to go in for reciprocity with you, but I would like to remove the impression that we are willing to do anything to get the American market. We are not. We can find a market in the old country for our cheese which will no doubt be more profitable than the American market. The kind of cheese we are making at the present time is made especially to suit the British market.

To come down more to the details of the cheese industry in Canada. The patron of the cheese factory is rather a peculiar individual. Sometimes he takes a great deal of interest in the cows, in feeding and the care of the milk; but in many cases he does not take the interest which he should in view of the fact that the raw material coming from the farm is the most

important factor in building up the cheese industry. Our patrons are gradually taking more interest in the care of the milk and of the dairy cow, but too many are still indifferent; and our makers complain that it is impossible for them to make a fine quality of cheese out of the mlik they are receiving. All makers have been working to educate their patrons in this line for the past few years, and the quality of milk furnished to the cheese factory is improving slowly.

The short horned or Durham grade cow is the one most frequently met in Canada. More Ayrshires are found in the eastern part of the Province of Ontario than any other grade, largely for the reason that Ayrshire milk is especially suited for the manufacture of cheese, because of the smaller size of the fat globules which are more easily mixed up with the milk and do not separate readily on standing for a short time. For cheese making the butter fat should be thoroughly distributed throughout the milk. Scotland, the home of the Ayrshire, makes the finest cheese in the world. I think you have the Scotch in this section of the country for in some of the questions asked I have heard the Scottish acccent. The Scotchman wherever you find him always makes a good dairyman, and in the very best Canadian dairy and cheese sections we find the Scotch nationality predominant. We have nearly all the other breeds, but the Short-horn or Durhams predominate. Holsteins are being introduced to a large extent, but the Jersey cows have not obtained the foothold in Canada which they have in the United States.

I was very much interested in the discussion a few minutes ago as to the money returns from cows in the State of Vermont. I presume that the returns to the patrons of the cheese factories in Canada will run from about $15 to $50 per cow, and that the average would be $25 to $30 per cow. The returns from a cow depend largely upon the cow and the care and food she receives. During the past season in Western Ontario we had a very dry season and as a consequence patrons who had provided no green food for dry weather found their receipts low although prices were high. But those patrons who took care to provide green crops and fed meal and corn silage to their cows during the summer time, got renumerative returns.

In Canada we mix two bushels of oats with one of peas and sow from two to two and one-half bushels per acre with an ordinary grain drill for a soiling crop. This past season we have feed corn silage in connection with our other foods during the summer and think it an excellent food. Some of our most prominent dairymen at the present time, are advocating summer silage only as a pasture adjunct, but in many seasons in fact, in the majority of seasons it pays to have the green

crops and also some meal. We can get bran for from $8 to $14 per ton. We think bran makes one of the best foods for the production of milk. It is the cheapest food we can buy. We buy all our food in the dairy department of the college and we find bran very economical both in summer and winter for milk production.

It is not only important that the cow should be well fed and well cared for, and the milk properly cared for, but in the manufacture of cheese it is also necessary that the milk shall be delivered at our cheese factories as promptly as possible after being milked, and it should be protected from the sun and dust and those things which detract from its quality. In some sections where the milk is hauled a long distance it is a difficult matter to deliver it at the factory in good condition. Patrons living within three miles of the factory have an advantage in getting the milk to the factory early and of good quality.

It is important to have a first class cheese maker. Our dairy sections are developing a class of men who are able to turn out a fine quality of cheese. Last year Dr. Dillon, one of the foremost cheese makers of Canada, addressed you on the details of cheese manufacture, and on that account I shall not touch upon that phase of the subject.

As to the curing of the cheese: It was thought at one time that when cheese was made and put into the curing room all was done that was necessary. We now know that the cheese when it goes into the curing room is only half made. In 1898 our customers were asking for a cool, mild flavored cheese. The past season we have not heard so much of that. It is reported that some of our factories have been taking the cheese out of the hoops on Saturday and shipping them out on Monday. This is a great mistake.

Our people are trying to overcome the disadvantage of curing cheese at a high temperature. At most of our factories there are put on an ordinary room, two ply of building paper. then two inch strips, building paper inside of that, lining finally the whole inside with matched boards, the whole costing perhaps in the neighborhood of $100. We also recommend the use of double windows and double doors. To get light without heat we are using over the windows a paint of white lead and linseed oil which makes the room light and keeps it from getting warm. In a number of our factories are ice boxes about three or four feet square raised about a foot from the floor, with a galvanized tin underneath to catch the drippings. A number of factories which have adopted this plan of cooling have found that they can keep the temperature from rising above 70 degrees. When the temperature rises above 70 or 80

degrees the butter fat becomes disassociated from the caseine, runs through the bandage and on to the floor, thus wasting food material. This loss of fat moreover injures the texture of the cheese. I am not able to explain fully why curing the cheese at a high temperature causes a mealy cheese which nobody likes.

The following method known as the sub-earth duct of controlling temperature is also largely used. A trench is dug about six to eight feet deep from 150 to 200 feet long, and about six rows of ordinary drain tile six inches in diameter are put into the bottom of the drain. At the further end of the drain is a tall pipe. The air plays in through the pipe and through the drain tile and becomes cool. In our own curing room we seldom find the air rising above sixty-five degrees, or coming into the room at a temperature above sixty degrees. Other methods have been adopted. In one of our factories a row of pipe has been put around the room and cold spring water run through it. Factories having a large supply of cold water might find this an economical method of cooling the curing room. One of our boys bought a Westinghouse air compressor and controls the temperature of his curing room by compressed air. Another factoryman expects to use a fan next year and those who have used it for other purposes think that it is going to be the best method. Thus we have a variety of systems for keeping the air cool. It is important to keep the temperature between 60 and 65 degrees in the curing room.

In the fall and spring the curing room gets too cool without artificial heat, and the cheese may develop a bitter flavor, but if it is kept long enough this will pass away. Some factories use a stove surrounded by a sheet of galvanized iron, others a furnace resembling an ordinary house furnace except that it has no pipes for distributing the heat. It is surrounded by an iron jacket placed about six inches from the floor and the air as it becomes heated rises and the cold air is drawn from different parts of the room under the jacket. Those who are using the furnaces like them very much indeed. We use steam heat in our curing room.

I have dwelt at some length upon this question of curing cheese because it is a very important point in making good cheese and one of the most complicated problems in cheese making. Our results indicate that by curing at from 60 to 65 degrees we get more cured cheese from one hundred pounds of cheese put into the curing room, a better flavor and texture, and one that suits better the English customer.

I wish in conclusion to speak of true cooperation. We have in Canada a form of cooperation but not true cooperation.

Your cheese factories are called cooperative factories, so are ours, but they are not true cooperative factories. I claim that there should be uniformity of effort from all classes. If we divide the classes into the producer of milk, the manufacturer of milk, and the distributors of the finished product, we shall find that each of these is trying to get all he can out of it, and is quite willing to allow the other fellows to take what is left. I hold this is not true cooperation. We shall never rise to the highest estate until these three classes work together, instead of everyone trying to get what they can out of the business regardless of the rights of others. As it is at present the producer of milk is chiefly interested in getting his milk taken into the factory and that is about as far as he is interested, if he gets his money. The manufacturer is trying to get all he can get out of it, and when he gets his goods sold to the buyer that is all he cares, and the buyer is trying to get all he can out of it; and as a consequence the patrons in many cases do not receive the just proportion of the final sale of the goods.

The patrons do not work together; they have not the same organization, the same business training as the other classes; and they come out, in many cases, at the little end of the horn. Now when we have these three classes working together we shall have true cooperation. I hold we must have the manufacturer taking more interest in the patrons, the patrons taking more interest in the manufacturer of his goods, and the railroad and steamship companies doing their share, before we can do the very best for the improvement of the dairy industry. Unless the producer of the milk finds it is profitable for him he will not try to assist. He is the foundation of the industry, and in building it is very important to have a good foundation. I believe we cannot pay too much attention to the foundation in cheese making, in butter making, or in any other business.

President Pierce. After listening to this very interesting address we can fully enter into the discussion which should follow.

Mr. Stafford. Do you have a private manufacture of cheese?

Prof. Dean. To a very small extent indeed. Our cheese is practically all made in factories on the cooperative plan.

President Pierce. Which produces the highest class of goods?

Prof. Dean. For export trade, the factory or cooperative plan.

A. P. McKinstry. When our Canadian neighbors went to

the World's Fair in 1893 with two carloads of dairy products, a small per cent. of it was butter and a large per cent. was cheese. One carload consisted of a deep silo on trucks which contained a cheese, and the Agricultural Department had to re-floor the Agricultural Building to get it in. The cheese made in the Canadian factories rather took our men by surprise and our cheese makers were put on their mettle. If I remember right your cheese makers took away their share of the prizes but as this gentleman says in their butter product they were not so fortunate and it did not receive quite so many prizes. In my state, in the western part of Minnesota, we do not make export cheese. They are making the soft cheese and it gets readily into consumption. I do not think the export cheese there would find a ready sale at the prices received. We like to turn our money oftener.

Member—Are your cheese factories run summer and winter alike?

Prof. Dean. We make practically no cheese in the winter time although this winter some of our factories have been running until the first of January. We strongly recommend that cheese be made for only about six months in the year that our best factories are putting in butter making machinery and are manufacturing butter during the balance of the year.

Member—Have you observed any tendency on the part of the cooperative institutions to change over to proprietory factories.

Prof. Dean. Yes, a great many of our joint-stock company manufacturies are selling out to individuals. But where a joint-stock company is properly managed it is as successful and renumerative to the patron as is any form.

Member—How do you use summer silage?

Prof. Dean. Where we are milking twenty-five cows we aim to have about four or five feet of square surface per cow, depending upon what proportion of the summer feed you would use in the form of silage.

Gov. Hoard. A word on the question of summer silos. About forty of our patrons have summer silos; it is quite a recent thing. These men have seen practically no shrinkage in their milk this summer; and we all know that when cows have dropped there is no getting them back, no matter how high the price may be afterwards. I shall build next summer, two silos, a summer silo and a winter one. The summer silo will be constructed narrow. When you uncover the top of the silo in winter you have the cold weather to prevent the souring of the ensilage while in summer the hot weather promotes souring, therefore build narrow. I shall figure five tons per

cow from the winter silo and one ton per cow from the summer silo.

Mr. Smith. I want to say a word about summer silos. We have about forty cows and a forty-acre pasture and have to depend quite largely upon some other form of feed. Formerly we made large use of oats and peas, but for the last three seasons we have ensilage left so we could feed our cows almost entirely from that during the summer season. From about the first of July on through they would eat two good feeds of ensilage a day. Viewed from the standpoint of economy and convenience, we believe our cows do better fed on the summer ensilage than they ever did on any other food we have given them.

Question. What is your average production this year?

Mr. Smith. We have about forty cows and heifers and have sent to market 14,206 pounds, some 350 pounds per cow.

Mr. Stafford. I would ask Gov. Hoard his plan of building silos.

Gov. Hoard. There are many plans and every man plans his barns and silos according to the lay of his land. I shall build a new set of barns on a farm I bought in August; they will be in the shape of a barn and an ell; one barn will be eighty feet long and forty feet wide and the other will be forty-six feet long and forty feet wide. The silo will be on the outside in the form of a half circle opening into the barn, at the head of one of the feed stables. There will be two of them, one will be a larger half circle that is up against the wall of the barn, and the other will be smaller, I aim to get as high a silo as I possibly can, in order that I may get a more thorough settling. We make the summer silo smaller so that we will uncover less and go deeper. These silos will be built more expensively than most men will. It is no pleasure for me to build two in my short life. We get little frost because of the height of the silo, and moreover if it does freeze it does not hurt it. You throw it into the barn and if its temperature is not below fifty degrees, even if the ensilage comes in frosted it will not be but a little while before it will thaw out. I never have known it to freeze to a depth exceeding three or four inches and in a great many instances I have known it not to freeze at all.

Question. What kind of lumber are you going to use in the construction of your silo?

Gov. Hoard. Cypress. It will cost me a third more but stands fermentation the best of any wood I know.

Question. What is Wisconsin temperature at this time of year?

Gov. Hoard. Last winter it went forty degrees below zero.

Member—Would it be practicable to feed from the small silo though September and October and then leave it and begin the next summer again.

Gov. Hoard. Do you mean whether it would keep over? I have seen it where it had remained in the silo five years and come out perfectly good. Ensilage is really nothing but canned corn fodder and you know canned goods will keep indefinately. The men who are worrying most about the silo are the men who do not have them.

Mr. Gray of Ashfield, Mass. We have two silos twelve feet in diameter and about thirty-six feet deep, the staves are hemlock, six inches wide. We have used it about four years and our ensilage keeps perfectly.

Question. Was the lumber kiln dried?

Mr. Gray. No sir, when we built the second silo the stock was so green the moisture would ooze out when we drove the nails in.

Afternoon Session.

President. In the absence of Gov. Hoard we will take up the last subject on the programme first.

"BREEDING, CARE AND MANAGEMENT OF DAIRY STOCK, ETC."

GEORGE AITKEN, Woodstock.

There are at least ten recognized breeds of dairy cattle in this country, and all of them more or less valuable in some branch of dairying; but I am sure that you will all agree with me, when I say that the Jersey as a breed stands preeminent among them as an economical producer of first class butter, and as this kind of butter is the "sin qua non" of the Vermont dairyman, it is absolutely necessary to learn all we can about breeding the cow which produces it.

In the first place, how came this particular breed by their inherent quality of producing rich milk? Simply by the force of circumstances. The inhabitants of the Channel Islands finding no sale for their surplus milk at home, made it into butter for shipment to foreign markets, as this trade developed, it naturally followed that the individual cows giving the most butter came to be the most valuable and, their progeny more sought after, this, in connection with the circumscribed area of the Island, and the making of a law as early as 1779 rigidly prohibiting, under heavy penalties, the landing upon the Island of any live animal of the bovine race, has given us the Jersey cow of today. The oldest breed of improved cattle we have any knowledge of. With this grand foundation, it would seem an easy matter to continue this improvement of the breed along the same lines, but, while we in this country are raising Jerseys giving, in some instances nearly double the amount of the Island bred cows, I am afraid we are losing sight of the most valuable characteristic of the breed, which is economy.

We have succeeded (so the records tell us) in getting a cow to eat fifty pounds a day for a week, of the most nitrogenous grains, besides a quantity of beets, cabbages and apples, and giving (thirty-six pounds of butter), this is interesting as

showing what a cow can be made to do, but it is not economy.

The growing tendency is to produce a cow of larger and coarser frame, such a cow may give more milk and butter than a medium sized cow of fine bone, but my experience has been that she will not do it so profitably.

In the first place, she will require more food to keep up her larger frame, second, she will not assimilate her food so well, in other words she will be a hard keeper.

There is one dairy breed in this country which has that fault very largely developed, and it was the rock they struck on while preparing for the "Battle of the Breeds" at the Columbian Exposition, when the committee insisted on the cost of the food being taken into account, the owners of this particular breed very wisely withdrew, knowing full well they would have no chance against the economical little Jersey.

I am often asked what I consider the best type of a dairy cow that is, a cow that will turn the rough fodder of the farm into milk with the least possible waste and also produce the most milk per acre from our hill pastures, and I unhesitatingly affirm that it is the Ayrshire type. A number of years ago I tried an experiment with three each of the best specimens of five dairy breeds, as to their capacity to earn their living, they were turned into a large pasture where feed was rather short, with the result that the three Ayrshires kept up their milk flow and also their weight, the Jerseys kept up their flow of milk, but lost slightly in weight, the other breeds all dropped in their milk, some of them going almost dry and they all lost in weight, in fact one of the breeds might have starved to death if the experiment had been continued longer.

The success of the Ayrshire I attribute largely to her strong vitality, coupled with her perfect form, "she is built for business" and if I could only graft the inherent rich milking quality of the Jersey into the businesslike body of the Ayrshire I would have a nearly perfect cow.

This we cannot do without running the risk of losing the best characteristics of one or both breeds.

As all of our different breeds are probably descended from a common ancestor, in mixing them we are liable to be confronted with Atavism, one of the main things breeders have to contend against.

But although we cannot reach the desired goal by the short cut of crossing the breeds, there is no reason why we cannot breed the Ayrshire form on to the Jersey, it may take time, but we know that it is comparatively easy to change the outward form of our domestic animals, as an example of what is being done in that line, I have here two cows which you can compare with the typical Jersey of twenty years ago, and here

let me say, that the champion of all breeds at the World's Fair test was very largely of the type I have tried to describe, had she had upright horns she might have passed for an Ayrshire. ·

One of the cows whose photograph you see here, won the first prize as a three year old at the World's Fair and although she was by far the youngest cow in the ninety day test she stood number twenty-nine among the seventy-five cows in the test, this photograph was taken just before she entered the ring to compete for the sweepstakes for the best Jersey in the show, where she won the second prize.

This other is a picture of Lily Garfield, the champion of the heifer test at Chicago, she was only four days over two years old when she entered the test, almost a year younger than any of her competitors, in the twenty-one days of her test she made a clear profit of $11.22, whereas the next best Jersey only made a profit of $8.985. Those are the kind of cows we want in Vermont, "The kind that will make money." I merely brought these pictures to show what is being done in Vermont today, and also to show you what a grand opportunity you farmers and farmers' sons have to evolve a family of butter cows that will eclipse the fame of Morgan horses and Merino sheep, and which will bring more money into the State than both of these industries combined.

The most common mistake made by breeders when endeavoring to propagate and increase a certain characteristic, by mating two animals who show that desired characteristic and entirely overlooking the fact that a decided fault in conformation may be prominent in both animals, the results in such cases are very apt to be disappointing, as the defects of both animals are quite likely to crop out and be doubled in the offspring, than the desirable qualities it is sought to augment.

In fact my experience goes to show that defects are more easily propagated than good qualities, it is therefore essential in mating animals to produce certain results, great care should be exercised, not only in the animals themselves but in their progenitors, as much as possible to see that no objectionable points are present.

But in breeding butter cows there is one point which must never be lost sight of, that is, the external indications of rich milk.

Now we hear a great deal about the beef type, and the dairy type, but you never hear anything about the butter type for the very reason there is no butter shape. The only external indications of rich milk are a soft mellow hide covered with soft wooly hair, and that placid, motherly look so frequently met with in the best types of beef cattle. To sum it up, it is that

quality which is so much sought after by beef breeders, the ability to lay on flesh or to turn their food into fat. This quality in conjunction with what is termed the dairy type, denotes the ability, or rather the propensity to turn the food into butter fat instead of putting it on their bodies.

No other breed has this ability to the same extent as the Jersey, and there is a fortune awaiting the man who has skill and patience enough to produce a family of cows of the true economical dairy type with the butter secreting powers of the little Channel Islander.

Mr. Smith. How do the Island Jerseys of today compare with those that have been breed in this country?

Mr. Aitken. I am glad the question has been asked because you might get an idea from my paper that we have not improved on the Island animal here. I walked all over the island of Jersey last spring looking for a bull with certain characteristics that I wished to propagate, but I could not find one on the island that suited me. The question of price did not enter into it at all. While I saw a great many beautiful Jerseys on the island, I am perfectly well satisfied that we have in Vermont better and more profitable Jersey cattle than they have on the island today.

Question. In what respect are they better?

Mr. Aitken. More economical. That is the point I wish to emphasize. The Jersey cattle on the island today have been sacrificed to beauty. There are some splendid cattle on the island but the chief characteristics of the breed has been sacrificed to deer-like prettiness. The Islanders are breeding for the market, that is the kind they can sell, and they are breeding the cattle for the men who will pay the highest price. This will change I think before long because the Danes are going over there to buy Jerseys.

Mr. Stafford. Is the high feeding for breeding stock safe?

Mr. Aiken. No sir. Feeding too highly concentrated foods to breeding stock or growing stock is one of the worst things that can be done. During the boom in Jerseys a few years ago a good many speculators went into the Jersey business. They took their calves as quick as they were dropped and fed them as highly as they could largely on concentrated foods. The result was that they brought in the prettiest animals you could look at, shaped like a deer, groomed like a race horse, but I have not found one of those animals raised under that method that was good for anything.

Mr. Stafford. Is it safe to use cottonseed meal?

Mr. Aitken. I do not use it. The question of feeding the animal is very essential. My method may not be the best, but it is the best I know of. As soon as I take the young

calves off milk or before, I begin by feeding them on the coarsest, rough food they will eat in order to develop the digestive organs. When our heifers are a year old or less, in the winter time, they are turned out of doors in the barn yard and fed on rough fodder, without grian. I feed corn stalk, hay and all the turnips they will eat. In that way I claim to get her digestive organs so developed when she comes to maturity that she will assimilate her food better and make butter at a less cost per pound than if otherwise grown.

Question. Don't you believe in feeding a young cow that is to come in so as to develop the milking qualities?

Mr. Aitken. Certainly.

Question. What is your treatment of the young calf?

Mr. Aitken. We take the calf right away from the cow, never let it suck, give it new milk. As a rule we do no feed the calf new milk over a week; then we begin to take the fat off the milk and use cheaper substitutes, cooking flaxseed meal until it is a jelly, and by the time the calf is a month old we can feed it oat meal, then feed a mixture of flaxseed and oat meal as long as it is necessary.

Gov. Hoard. How long would you feed a calf skim milk?

Mr. Aitken. Until they are six months old.

I was very much interested yesterday in the discussion concerning cottonseed meal. I do not feed it, I have made butter for the Philadelphia, New York and Boston markets and my experience was very much like Mrs. Nelson's. I was carried away by the praise of cottonseed meal in making butter when I was supplying the Philadelphia market and tried it with the same experience Mrs. Nelson had. The buyer wanted to know what was the trouble with my butter stating it was "off" flavor. I stopped it right off. I tried it again for an experiment when I made butter for the New York market with the same result, and I had the same experence with the Boston market I again tried it. So I do not feed cottonseed meal and I cannot give you any idea whether it is a detriment to growing stock or not.

Question. What concentrated food do you feed?

Answer. I feed ground oats and ground corn on the cob and flaxseed meal.

Question. You do not feed gluten?

Answer. No sir.

Question. You do no feed ensilage?

Answer. No sir.

Question. Feed bran?

Answer. No sir.

Question. How much cottonseed did you feed a cow?

Mr. Aitken. I tried all sorts of rations, I have fed to see

how much more butter I could make irrespective of quality; I fed as high as four quarts a day, I do not recommend it.

Question. What is your objection to ensilage?

Mr. Aiken. My objection to ensilage is the old one, I presume you have heard it. If you get me started on ensilage you will be sorry.

President Pierce. I wish you would tell us why you do not use ensilage?

Mr. Aiken. When they began to make ensilage I went to see some of the silos when they were opened. They smelled so much like a distillery to me, that, being a temperance man, I could not think of feeding it to my cattle.

Question. Have you ever eaten the bread made from compressed yeast?

Mr. Aitken. Yes.

Question. Would not the same objection apply here?

Mr. Aitken. No, because I believe that the ensilage undergoes a change which makes it a stimulant. I object to too much of a stimulant. Incidentally I would say that I consider it is largely the cause of the epidemic of tuberculosis that we had in Vermont, although that is a broad statement.

Maj. Alvord. Give us some reasons for your statement?

Mr. Aitken. About eighteen or twenty years ago a gentleman living in Vermont, asked me to look over his herd with him. I did so. It seemed to me a good deal like going into a fever hospital. The cows were looking as though they were washed out. I said there was some trouble with the cows. I was told that the cows were never doing better, were eating sixty pounds of ensilage a day and were making more milk than they ever had. I think you know the sequel, that all tuberculosis of the state has been traced to that herd. Now, while I do not claim that feeding that ensilage originated tuberculosis in that herd, I know he bought the disease. Yet I claim that the food those cattle were getting and the conditions under which they were kept were conducive to tuberculosis, that the whole surroundings were conducive to the spread of tuberculosis.

Mr. Smith. Have you not seen a change in the quality of ensilage in eighteen or twenty years?

Mr. Aitken. Certainly.

Mr. Cooley. How much ensilage have you fed to cows?

Mr. Aitken. Quite a good deal. I had a disastrous experience with brewer's grains; and the ensilage smelled so much like that material I didn't like it.

Thursday Morning.

Meeting called to order by the President at 10 a. m.

"WHAT MAKES THE MILK TEST VARY SO?"

JOSEPH L. HILLS.
Director, Vermont Agricultural Experiment Station, Burlington, Vt.

Let us consider this matter under three heads:

I. Why does the milk delivered by different patrons vary in test?

II. Why does the milk delivered by the same patron when taken to different creameries vary in test?

III. Why does the milk delivered by the same patron, at the same creamery, vary one week with another, and one month with another; why does not its quality remain unchanged?

I. VARIATION IN TESTS BETWEEN INDIVIDUAL PATRONS.

1st. Why does Smith's milk test differ from that of Jones? Differences of breed, individuality, food, nervous excitement, environment, weather and the stage of lactation may influence the result. Let us sketch some of these.

BREED.

Every observing dairyman appreciates that differences in cattle, due to the character of their breeding, are such that some cows give richer milk than others. The Channel Island cows have been bred through many scores of years with a specific purpose in view, to make a high grade milk; and, on the other hand, the cattle of Holland and Scotland have been bred generation after generation more particularly to make a large quantity of milk. While there are exceptions to every rule, still, speaking broadly, Jerseys and Guernseys give richer milk than do cows of other breeds. Smith's test outranks Jones, because long lines of breeding with a definite aim in view have implanted in his animals a tendency toward making a better grade of milk than can Jones' cows.

INDIVIDUALITY.

While the differences in breed are frequently concerned in the test variations as between one patron and another, the individuality of the animal is often quite as important. There are families within breeds. The cows of some families of Jerseys give relatively good milk, and others in other families relatively poor milk. Mr. Vail refers elsewhere in this report to experiments at the Vermont station which indicates that heifers resemble the dams rather than the sires as to the quality of the milk. He qualified his remarks however, by saying there had been but little observation on this point. I am inclined to believe that the quality of the milk of the several heifers in the tests cited resembled the milk of their dams rather than that of the females of the sire's line because of the inferiority of the sire. The bull's pedigree was of the best, but individually he did not have that strong power, that prepotency which some bulls possess to fix upon the offspring the character of his kind. I attribute the likeness of these heifers to their dams to this ineffiicency on the part of the bull and do not wish to go on record as believing that the use of a good bull from butter lines is not sound practice.

FOOD.

He who looks to food to grade up the quality of milk looks in vain. Food variations may increase the quantity of milk, but seldom if ever bring about permanent changes in quality. If a cow is fed a very scant ration she may alter more or less the quality of milk given ; but when a cow is changed from a good, palatable, plenteous ration to another of similar grade, but differently made up, no material change in the quality of the milk is likely to follow, providing the rations are normal. We have been trying for years at Burlington to persuade cows to change the quality of their milk, but at no time and in no way have we brought about a permanent change. When we have poured melted fat (vegetable oils, like corn, cottonseed, linseed oils, etc.,) into the cow we have temporarily changed the quality of milk. I expect that feeding with sugar, which we are trying this year, may change the milk somewhat in its character, possibly permanently; but with no normal, rational food can one persuade a Holstein to give Jersey milk, unless it be by semi-starvation. If a cow is starved she is apt to make richer milk.

NERVOUS EXCITEMENT.

Such conditions as may be provocative of nervousness have more influence upon the quality of milk than most

people are apt to think. I once heard a Maine dairyman say that in his judgment the best thing on a dairy farm was a dead dog, and that a coat of whitewash in the barn was a close second to it. A dog once thoroughly killed never again dogs cows, and thus one of the most common sources of bovine agitation is removed. Milk-making is a nervous function and in proportion as a cow becomes excited, in proportion as the nerve force which should be concentrated upon milk making, is distracted therefrom by any cause, dogging, horn-flies, abuse, noise, etc., in that proportion there is likelihood — almost certainty — that the milk flow will be influenced. If I remember right, our good friend from the west, tried a few years ago an experiment in this line. I believe Gov. Hoard was the first man to urge that a cow be treated as if she was a lady; but once upon a time he abused a cow in order to know whether or not it would affect the quality of the milk. She was milked in part, then with a large pin she was raked across the udder and the milking continued.

Gov. Hoard: (interrupting) If you will allow me: The experiment was made in this way. The cow was milked about half through and a sample of the latter portion of the milk was set aside; then a heavy pin was raked across her flank. She made a jump into the manger. She was a great pet of mine, and she looked around at me as much as to say, "you did'nt do that, who did?" I then finished milking and took a sample of that milk. There was a difference of fifteen per cent in the amount of butter fat in the two halves of the milk. I took a sample immediately as we closed the first half, and then another at the beginning of the last half. I did not wait to get through the stripping. There was a difference of fifteen per cent in the amount of fat eliminated by the nervous equation. And a man who does not treat the little mother in a motherly way, as he would treat the mother of the family, who does not treat her in the same way as a mother treats herself, makes a mistake.

Prof. Hills. I am glad to have the governor tell the story for me. We get it thus at first hand. Another experiment in the same line: One of our western experimenters fired blank cartridges in front of the cows immediately before milking. The explosions decidedly affected the quality of the milk. Anything that tends to make a cow nervously excited will be apt to effect the milking function and, as a rule, unfavorably. In our own experience an Ayrshire, temporarily in new and noisy surroundings, increased the quality of the milk without decreasing the flow, while another Ayrshire at the same time, treated in exactly the same manner, did precisely the reverse and shrank half in quality and a quarter in

quantity. Why should we expect a cow or herd of cows always to give week after week, the same quality of milk? Milk making is the cow's work, just as agricultural investigation and teaching and executive duties are my work, and the sundry farming operations, your work. Do we always work as well one day as another whether we feel well or ill? Though in the best of health do we do the same amount of work each day? Why should we expect a cow to do the same day after day? Her work is expressed by the milk she makes, and, largely, by the per cent of fat she puts into that milk. We should not expect of her what we ourselves cannot do.

STAGE OF LACTATION.

The stage of lactation is another reason why Smith's milk differs from Jones'. It is well known that cows tend to better the quality of their milk as they progress in lactation. Investigation has shown that cows differ greatly in this matter. Some vary but slightly and others largely as they pass from freshness to stripping. A farrow cow goes dry giving milk but little richer than when she came in; a pregnant cow going dry usually gives considerably richer milk than when she came in. Experiment has shown, moreover, that on the average the increase from calving to drying-off approximates 1.25 per cent fat, that is to say a milk testing 4 per cent at calving may test 5.25 per cent of fat at stripping. Smith's milk may be made largely by strippers, while Jones' cows may be mostly fresh in milk.

It is now generally understood that the quality of the milk of the same herd varies decidedly from day to day, from milking to milking, and that, in order to represent correctly the weekly or monthly quality, it is necessary to take a composite sample. It will sometimes happen, however, that even when composite samples are used tests may vary one week with another fifty, sixty or seventy points. I believe it is the duty of the creamery management in such case to verify the result by retest. Many patrons have an exaggerated idea as to this matter. For instance, a few years ago a creamery patron told me that he was being defrauded, that his test at the creamery one month was 3.90 and the next month 3.85. These five points, 0.05 per cent, seemed to him enormous. No operator can take the same test in the same Babcock bottle and always read it twice alike. Two-tenths of one per cent is not a wide difference between two tests, and three-tenths of one per cent as between one month and another, even when the cows are in full flow, is hardly a wide enough variation for cavil; more

than that is of importance. But, as I shall say later on, one should not growl but investigate.

II. Variation in Tests between Creameries.

Why should Smith's milk, taken this week to Brown's creamery and next week to Robinson's creamery, test differently?

When we go to bed at night we breathe a prayer in which are to be found the words "Lead us not into temptation." Human nature is so constituted that it often happens that a patron, who takes his milk from Brown's creamery to Robinson's, is essentially leading the latter into temptation, into which he is apt to fall. He may feel inclined to raise the test, to make it read, or to report its reading, higher than it really is. In my judgment such a test is not a test of the milk, but of human nature; and the milk of human kindness is altogether too apt to be curdled by such a trial, as is the milk of the cow by the sulphuric acid of the Babcock method. Such a comparison has no standing and means nothing. There are better ways whereby one may find out whether Brown's work at the creamery is correct or is not correct. One may help himself or be advised by the experiment station.

HOW TO CHECK THE CORRECTNESS OF CREAMERY TESTING.

I believe that a Babcock apparatus should be located in every dairy community in the state of Vermont; and that there should be there, also, some young man or woman capable of running it in a satisfactory manner, whose services could be had by any one in the community at a small consideration. I do not advocate that all dairymen own Babcock apparatus. Some farmers are not fitted to run it properly. A Babcock incorrectly run is worse than none at all, since the results are more misleading than instructive. If the test apparatus and some man or woman who is careful and, capable of running it are available, one may know, if he wishes to, whether his creamery is doing him justice or not.

If the community is unwilling to combine in this way, its dairymen may turn to Burlington, where there is an institution which is helpful to hundreds of dairymen in the state in this very way. It is a common thing for Smith, who doubts whether Brown's test is correctly or honestly made, to take a sample and express it to the experiment station; and then if its test differs from Brown's there is music in the air.

Gov. Hoard. How may you know that the sample that Smith sends has not been tampered with?

Prof. Hills. If Smith is a rogue, if for any reason he is bound to make his creamery wrong, whether or no, it is easy

for him to manipulate the sample. So can Brown tamper with samples. Yet if the men are sincere and anxious to know the truth, there are ways in which they can insure accuracy. Some little time ago the experiment station put out a four page bulletin,—reprinted at the end of this article,—giving methods of sampling milk and cream. This has been printed in poster form and is to be sent in the spring to every creamery in the state of Vermont with the request that it be posted near the weigh-can. We give three schemes for sampling whereby the patron who desires to check the testing work of the creamery may do so; first, the creamery sample may be halved, second, the creamery man may be required to take duplicate samples, and, third, a patron may take his sample for himself. Neither of these methods of sampling will insure absolute accuracy. Errors of omission or commission, of ignorance or intent, may be made. If the creamery samples be halved, if Brown is asked to furnish half of it that it may be sent to the station, it is located, prior to halving, in the control of one of the interested parties, the creamery man, and if he is inclined he may tamper with the sample instead of with the result. If the second method is used, if every time Brown's operative puts a gill of milk into his sample jar he puts one into the jar which the patron holds, the objection may be urged that the sample is in the hands of the other interested party, the patron. If the dairyman takes his own sample at home, he may be ill informed as to necessary precautions in sampling, or careless, or, indeed, intentionally deceitful, and the sample be not truly representative. In short there is no way in which the station can be certain that the samples sent it are correctly taken. Hence we are careful in our reports to those sending us samples to disclaim all responsibility as to the accuracy of sample-taking. I think, however, that this bulletin, which is to be sent to be posted in every creamery and cheese factory in the state, which is to be mailed by thousands throughout the state to our mailing list, and which concludes this article, will do something to make the samples that come to us more uniform and trustworthy.

III. Variation in Tests within the same Herd,

Why is it that Smith's milk, taken to Robinson's factory or creamery, varies one month with another? Why does it not tes evenly?

Several of the reasons cited under the first head obtain here.

LACTATION CHANGES.

The change in lactation of the cows is one important reason

why there should be variation. The general tendency of the herd will be as the cows go along in lactation to give rather richer milk. While there are many exceptions, the general rule is that cows coming in in the spring will give a fairly even grade of milk for the first five months in their lactation, and then increase in quality until they grow dry. If they are farrow cows quality changes but little as time goes on. If an all-the-year-round dairy is used there should be less change on this account.

WEATHER.

Stress of weather is another cause of variation. We have given much time at the Vermont station to the study of the effect of temperature upon the milk-flow. Our results indicate that the quality of a cow's milk alters inversely to temperature change. When the temperature rises the tendency is for the quality of the milk to fall; when the temperature falls the tendency is for the quality of the milk to rise. There are, however, many exceptions to this rule. No attempt has been made to test this matter in long periods but only as to daily or weekly fluctuations.

SURROUNDINGS.

The environmental differences, the nervous excitement of the cow already mentioned, as they vary from time to time, may cause fluctuation in the quality of the cow's milk. The change from barn to pasture, or the reverse, lack of water, poor water, drying pastures, new milkers and the like, may and often do have influence. Then, too, it must be confessed that there sometimes occur fluctuations in the quality of the milk of a cow, and, occasionally, of a herd for a week or more for which no rational explanation can be offered. changes which. because of care in sampling and testing and the conditions surrounding the operation, are removed beyond all likelihood of being due to error rather than to fact. There is much that we do not know about cow nature and cow doings in milk-making. And here, as ever, those who know the most are those who impute the least, while those less well informed are the more suspicious of wrong doing.

An editorial in a recent number of Hoard's Dairyman is very much to the point in this connection. It says:

"The cow is not a machine that will turn out the same quantity or quality of milk from day to day, and consequently the milk varies according to the physical and perhaps mental condition of the animal. The physical comfort or discomfort of the animal is reflected in the milk pail, and if the great

mass of dairymen would only recognize this fact, it would have a beneficial effect in the state of the pocket book.

In a careful record in the yield of a herd of cows for several years the following facts were noted:

They varied in quality of milk from one milking to the next, and from day to day, the quality rising and falling without apparent cause.

The changes were usually within 1 per cent of fat, but one cow changed 2.68 per cent in two days.

The average change during the period of lactation was 1.34 per cent and the greatest change, 2.78 per cent.

The above herd was exceptionally well taken care of and sheltered, and the changes in quality of milk were thus much less than would be noticed in cases of animals kept under less comfortable conditions.

The dairymen should remember that exposure to cold. drinking large quantities of cold water, exposure to cold rain, fright, worry, heat, flies and dogs, walking several miles over poor pasture for food, starvation, soothing the cow with kicks or milking stool, will all remove fat from the milk and make such treatment more expensive than good shelter and kind treatment.

When a patron's milk shows a low test, let him make a careful examination of conditions at home before he lays the blame on the butter-maker or the test."

THE TEST SYSTEM.

This brings me naturally to the consideration of a phase of the question which I want to treat with the greatest care as to the words I use and the impression I leave.

I believe that among the serious factors in this matter of milk test variation are the *errors of the testing operation.* Let us discuss this possibility of error in the manipulation of the test under the sundry subheads, *sampling*, *apparatus*, *errors of ignorance and errors of intent.*

SAMPLING.

By no art of legerdemain can a milk analyst retnrn a correct result from an incorrect sample. I am inclined to think that a considerable part of the variation between tests is due to imperfect methods of sampling.

Three methods of sampling are more commonly in vogue, the dipper method, the core method and the automatic method. The first named is the most widely used of the three. From the mass of milk more or less, (almost always less) thoroughly stirred (and, indeed. often not stirred at all) a gill of milk is dipped for a sample. Such procedure may result in an

accurate sample and it may not. Fresh milk, not creamed, well aerated and stirred, carted over rough roads and drawn from cows not giving large fat globules, may be accurately sampled thus with a minimum amount of stirring. On the contrary, milk which has creamed, which is a day or more old, from Jersey or Guernsey cows, but slightly shaken in transportation if, in considerable quantity, cannot be mixed with sufficient thoroughness to insure accurate sampling by superficial stirring. The Vermont station several years ago did much work in investigating methods of milk sampling, as a result of which we are prepared to say with a fair degree of assurance, that when five hundred pounds of milk somewhat creamed is delivered at the factory, there is no surety of the accuracy of the sample taken therefrom by the dipper method, unless it be stirred for from two to four minutes, round and round and up and down. Hence it is wise to consider the advisibility of choosing some method which is more likely than this one to insure accurate sampling.

While there is no method of sampling which is not open to defeat through improper handling, there are methods wherein there is a greater proportion of automatic action than in the one just considered. The coring method is one of these. Several devices designed to core milk are used. The Scovell sampler, which was used in the world's fair tests in 1893, is a fair type of this class of implement. It consists of a small brass tube with a perforated sliding cap at the bottom. It is lowered into the milk slowly so that it will flow into the tube until it strikes the bottom, when the perforated cap slides over and closes the tube, thus procuring a core of milk. This method of sampling, provided the cream is not separated in clots and the milk is neither loppered or frozen, will take a correct sample if carefully used. It is more likely to take a correct sample than the dipper method, or, rather, is less likely to take an incorrect one.

There is, however, a method which suits me better than either of these, known as the automatic method. The apparatus for this consists of a weigh can covered by a cone-shaped wire cloth or wire mesh, and some means of withdrawing a small stream from the outflowing milk. This small stream may be abstracted by means of a small faucet, set at the bottom of the can near the outlet gate, or by means of a hole punched in the conductor head or spout. The pet-cock or faucet modification of this device on the whole approves itself to me rather than the other.

The milk being weighed, both the gate and the pet cock are opened and remain open until all the milk has run out. A small proportion, varying according to the size of the ori-

fice of the petcock is caught. The relatively small amount of milk caught in the pail is very readily mixed and the gill taken. This method is not only theoretically accurate but has proved to be practically correct in thousands of trials; and it has been found to obviate a large part of the errors and annoyances of sampling.

Question—Do you have a drip near the outlet of the weigh can?

Answer—The drip should be located within a few inches of the outlet of the weigh can.

Gov. Hoard. I believe the first device of that kind used was placed in our creamery and is yet in vogue. A hole was punched in the bottom of the conductor running from the weigh can to the vat at a point near the vat. The milk when turned into the weigh can is a good deal mixed, the gate is then lifted and it pours out in a rush and mixes itself running and tumbling over and over, and just as it nears the vat, a drop from every pound of milk falls into the jar. We get the drip as far from the weigh can as possible.

Prof. Hills. The fine wire-mesh strainer distributing the milk into a thousand streams serves to quite an extent to mix it. I do not advocate the automatic device unless the fine wire-mesh be used. This device has been tried over and over again as against extreme care in sampling, and has proved, I think, correct in every case. It may be mismanaged but it more surely takes an accurate sample than any other practicable method since the sample in part takes itself, regardless of care or lack of care on the operative's part.

APPARATUS.

A law was passed at the last session of the Vermont legislature which required, among other things, that the Babcock test apparatus used in dividend-making be accurate. I have on this table six bottles. Three are good and three bad. Can you tell me which is which? The manufacturer "guarantied" that all were accurate; yet notwithstanding this guaranty some were excessively inaccurate. Here is an accurate cream bottle. How do we know it is so? Not because the manufacturer says so, but because, in accordance with the state law, the experiment station has found out whether it is accurately graduated or not, and certified thereto, if correct, by grinding indelibly upon the neck of the bottle VtExSt.

One creamery insisted that we send back all the bottles we found to be incorrect. We did so. I doubt whether they were used, however, afterwards; for we ground indelibly upon six places on each bottle the word BAD.

We found that one out of every thirty pieces (three per cent) of the apparatus in use before the law was enacted was inaccurate. All the apparatus that is being sold by the Vermont supply houses today is correct, because it is all submitted to our inspection and only the correct pieces shipped them. As it comes to us now less than one-half of one per cent, one in two hundred, is incorrect.[1] Clearly this section of the law is of benefit.

The law is imperfect however. It should cover the accuracy of the centrifugal testing machines. There are centrifugal testing machines in use at creameries in this state so constructed that they cannot give correct results. The law should provide for the inspection of these machines and prohibit the use of such as yield incorrect results.

ERRORS OF IGNORANCE.

The law passed in 1898 requires that every operator of the Babcock test for dividend-making shall be examined as to his knowledge of the method of its operation; and that he shall secure a certificate from the dairy school of the University of Vermont and State Agricultural College that he is competent and well qualified to perform the work.

Mr. Messer. Are there any persons in the state who to your knowledge are at present operating these creameries without a license?

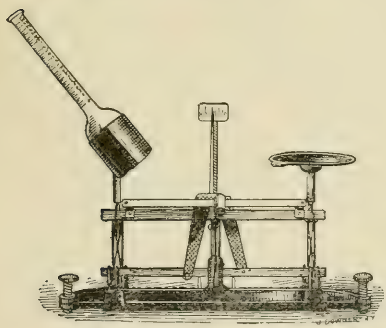
Prof. Hills. None to my knowledge. I presume there are some; but the law has a penal section and anyone may bring a case of that kind to our attention, or to that of any sheriff or constable. It should be noted, furthermore, that the law has forced many operators to perfect themselves so they could pass the examination and get a license, who otherwise would have tested with but a half-knowledge of the process. There have been tested over 13,500 milk and cream bottles and pipettes and 334 would-be licensees. Had it not been for the law, 243 incorrect bottles and 38 incompetent operators, unable to test correctly even under conditions when if ever they would have striven to do their best, would have been today adjudicating the value of milk at Vermont creameries and factories. Many incorrect pipettes and acid measure were detected and regraduated and are not included in this showing. A considerable number of operatives were refused licenses on the first examination, but were granted them after they proved, on second trial, that they had learned how to test milk. Every man testing in Vermont today at least knew how to

1.—Since writing, one very bad lot direct from a manufacturer who guaranties his goods has been handled and the imperfect pieces removed.

test when he took the examination. Whether in actual work he does as well as he knows is another story.

Many operators have protested against our ruling that they test cream on the ground that whole milk only was delivered at their creameries. We have insisted on this point for three reasons. In the first place the law says, and very properly, "milk and cream"; then, again, the farm separator is so commonly used, that most creameries are equipped and all must soon be equipped to test cream; and, finally, there is a greater likelihood of error in cream analysis than in milk analysis. This error is largely due to the fact that when cream is pipetted — particularly separator cream, or, indeed, any cream carrying over twenty-five per cent of fat — it is so thick that it does not flow readily. Eighteen grams is not delivered into the bottle by measuring eighteen cubic centimeters. Then, again, the cream may be frothy or filled with gas bubbles. These errors cause low results, unless they are avoided by the use of a correction table or unless the pipette delivery is weighed.

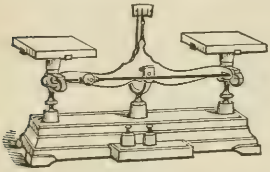
The correct amount of cream is most surely obtained by weighing the pipette delivery. So many fail in this matter that I want to make it clear. The apparatus needed is simply a small druggist's scale and a few weights. The empty cream bottle on one scale is balanced by the slide or weights on the other. An eighteen gram weight is added and the well mixed cream is pipetted into the cream bottle until the balance swings evenly. The test is then proceeded with as usual. The operation is no more intricate than is the weighing of the butter into the tub in which it is packed. It is precisedly the same thing, weighing into a weighed empty package a given weight of the material wanted. The extra time consumed need not be more than a minute to the sample, and as a result of its expenditure far greater accuracy is insured. Every patron taking separator cream to a creamery should insist that the management test eighteen grams of his cream, that they weigh the delivery of the pipette.



SPRINGER SCALE.

That this matter may be made the more clear two pictures of cream test scales are given. The larger one is manufactured by the Springer Torsion Balance Co., 92 Reade Street, New York, in accordance with the suggestions of the Maine exper-

iment station. The empty cream bottle is placed in the specially adapted left hand pan, is counterpoised by the slide and weights or both, and then eighteen grams of cream are pipetted against an added eighteen gram weight. The smaller cut shows a new scale made by Henry Troemner, 710 Market Street, Philadelphia, Pa. It is as nearly rust proof as possible, its three inch bearings are set with agate and its pans are made of porcelain. Its method of use is similar to that indicated for the Springer scale. These scales with weights, cost from eight to ten dollars and both are excellently adapted to the purpose.



TROEMNER SCALE.

ERRORS OF INTENT.

I believe in the "open door" system in a creamery. I would have the management open its books and its testing operations to patrons. I know of one creamery where the test is done in secret and the books kept under lock and key. Secrecy is unwise; publicity disarms suspicion. Dishonest methods of sampling or testing are used occasionally. I believe that "occasionally" is as strong a word as is warranted by the facts. I feel that ninety or ninety-five per cent of the troubles which agitate the patrons as to the test system are imaginary rather than real. The phrase is worthy of repetition and emphasis. Nine-tenths or more of the discrepencies in results are apparent rather than real. Yet, unfortunately, sometimes errors of intent, deliberate dishonesty, exist. I have, however, no sympathy for a patron who growls, or swears, or whines, who claims that he has no recourse, that he is in the hands of the management and must take what they give him, who alleges incompetence or worse, without striving to correct it or to confirm his allegations by investigation. He has recourse. He can, if he will, work out his own salvation, either by his own hand, by that of some bright young man or woman, or by that of Uncle Sam. If he is sincere, if he really wants to learn the truth, he can help himself or be helped to attain the right in the manner already cited.

One of my former associates on the State Board of Agriculture was wont to say, that in this era of trusts, which are viewed with some suspicion, there is the one trust we should accept to a greater extent than we do, and that is "trust one another." The present conditions in this state do not in my judgment warrant the wholesale feeling of distrust which is prevalent among patrons. I would substitute for the word

"distrust" one which I think will be found far more helpful as a means of arriving at the truth, one which will satisfy the creamery management far better, the word "investigate."

Do not *distrust* but *investigate*. I am confident that most creamery managements will gladly meet candid and sincere patrons more than half way in the investigation of apparent discrepancies and in the rectification of any proved inaccuracy or injustice. When the day of general mutual investigation dawns in creamery work there will be greater harmony between patron and management and better work all around.

UNIVERSITY OF VERMONT

AND STATE AGRICULTURAL COLLEGE.

VERMONT

AGRICULTURAL EXPERIMENT STATION

BURLINGTON, VT.

Special Bulletin, October, 1899.

SAMPLING MILK AND CREAM.

Dairymen are learning to use the Babcock test more every year upon their individual cows or the entire dairy, either using it themselves or having tests made for them at the creamery or by the experiment station. The results of analysis are useless and misleading if obtained on poor samples. There is reason to believe that many do not understand how easy it is to take an incorrect sample.

The following directions for accurate sample taking are printed for the information of the dairymen of the state. Copies will be sent without charge to any address on application to the Experiment Station, Burlington, Vt.

1. *To test individual cows.*—Provide as many fruit jars (pints or quarts) as there are cows to be tested. (Wide-mouthed bottles will do if jars cannot be obtained. If used, they should have tight corks. Narrow mouthed bottles make accurate sampling difficult and often impossible.)

Label each jar. Into each put preservative to keep the milk sweet. (Use either formalin, sometimes called formaldehyde, about 20 to 30 drops; or corrosive sublimate, colored with analin red, about ten grains; or potassium bichromate, not more than ten grains. Formalin is preferable and non-poisonous, the other two are poisons and should be handled carefully. These may be obtained at any drug store or at the local creamery.)

At the first milking pour the entire milk of the cow back and forth from one pail to another not less than three times

and then *at once* dip out approximately a gill (a gill cup on a long handle works well—a small teacup will do) and pour into the jar. Close the jar and keep it closed until the next milking. Proceed thus with each cow. At the next milking repeat the operation, adding a second gill of recently poured milk from the first cow to the gill taken at the first milking, and similarly with the other cows. Proceed thus for from four to eight successive milkings, keeping the jar closed except when putting in the milk. This makes what is known as the composite sample, one which is much more trustworthy than a sample taken from a single milking. If samples are to be transported, the last sub-sample of each composite sample taken should be made to fill the jar absolutely full to prevent churning on the way.

Cows vary considerably in the quality of their milk at different stages of lactation. If only infrequent samples are taken, most nearly accurate results (that is, such as will most closely indicate the average quality for the year) will be usually obtained if samples are taken approximately as follows:

Cows calving in the spring: One composite sample six weeks and another six and a half to seven and a half months after calving; or two composite samples, taken about two weeks apart, six months after calving.

Cows calving in the summer: One composite sample eight weeks and another six to seven months after calving; or two composite samples, taken about two weeks apart, from three to five months after calving.

Cows calving in the fall: One composite sample eight to ten weeks and one five and a half to seven months after calving; or two composite samples, taken about two weeks apart, from five to seven months after calving.

Samples taken at other times may give satisfactory results. Prolonged experience has shown, however, that greater likelihood of getting a correct average for the year is attained by sampling at these times.

II. *To test the entire dairy as a whole*—Prepare a fruit jar as under I. If the churn will hold the entire milking, pour it in and slowly revolve the churn for a couple of minutes, then draw out, taking a gill soon after starting the milk out of the gate. Repeat for several milkings, as under I.

If the milking is too big for the churn, pour the milk in each large can three or more times back and forth and after the last pouring of each can dip out at once a gill into a second jar. Having gills from each can united in the jar, pour these not less than three times. Take one gill and put into jar as under I. The stirring method of sampling from large cans should not be resorted to unless neither of those cited

above is practicable. If used, the contents of each large can should be vigorously stirred with a long handled dipper round and round, reverse, and dipping deep, for one to three minutes, and a gill taken into a second jar at once on the completion of the stirring of each can of milk, the several united gills to be poured and one gill taken for the final composite sample which should be built up as under I.

III. *To test cream from the dairy.*—(a.) Shallow setting cream. This class of cream cannot be accurately sampled or tested.

(b.) Deep setting or so-called "gravity" cream. The entire lot of cream merged together should be poured as with milk under II and a gill taken into a jar as under I.

(c.) Separator cream. Proceed as under III (b.) If thick, stirring may suffice as under II.

Not less than a pint should be used for a sample. Small samples and narrow-mouthed bottles are untrustworthy.

IV. *To test skim milk from a dairy.*—(a.) Shallow setting. If sour, add a little caustic soda or lye and mix and pour until fluid. Put a gill into a jar without preservative. Make composite sample (four sub-samples) as under I.

(b.) Deep setting or so-called "gravity". Pour or stir vigorously; take gill from each can and finally pour or stir the united gills and take a single gill. Make composite sample (four sub-samples) as under I using preservative.

(c.) Separator. Catch skim milk from three to five times each run, distributed throughout the run. Pour and take a gill for composite. Make four sub-sample composite for test as under I, using preservative.

Less time need be spent in mixing skimmilk than with the whole milk or cream.

V. *To test buttermilk or whey.*—Draw directly from gate or siphon; make use of the composite sample with preservative.

VI. *To check correctness of test at creamery or cheese factory.*—(a.) Halving creamery sample. When the creamery composite sample is complete and ready for testing, require the operator to furnish one-half of it. Be certain that the sample is thoroughly mixed by pouring, that all the cream from the sides of the jar, cover, etc., is mixed back into the milk or cream, and that the halving is done immediately after the last pouring.

(b.) Duplicating creamery sample. Every time that the party sampling milk at the creamery samples a patron's milk, the latter may require him to furnish a duplicate sample in a jar controlled by the patron. Duplicate composite samples may be made thus which should test closely alike.

(c.) Sampling at the dairy. Follow directions under II.

Either of these three methods of checking creamery testing is open to objection. In (a) the sample or testing may be incorrectly managed at the creamery, the sample being under control of one of the interested parties, the creamery man. In (b) the sample may be improperly handled by the other interested party, the patron under whose control it is located. Method (c) resembles (b) in this respect, and, moreover, results may be vitiated because of error or insufficient care in sampling.

The experiment station strongly urges dairymen as far as possible to make use of the Babcock test at their own homes. It is of more value as used between cow and cow than for settling money matters between man and man.

To such residents of the state as do not consider it advisable to make their own tests, or to have neighbors make them for them, the experiment station offers its services to a limited extent. It cannot do regular and wholesale testing for any individual or company, but will handle small numbers of samples without charge. It makes but few requirements, as follows:

1 Samples should be carefully taken in accordance with these instructions.

2. Wide mouthed jars should be used.

3. Jars should be filled absolutely full to prevent churning in transit.

4. Express charges should be prepaid. In case jars are desired back again, the express agent should be asked to affix a "free return empty" label on the package and it will be returned without cost.

5. The shipper's name should be placed upon the package for purposes of identification.

Thursday Afternoon.

Meeting called to order by the President who introduced Gov. Hoard who spoke on the subject:

WHAT SHOULD THE CREAMERY DO IN THE PROMOTION OF THE INTERESTS OF ITS PATRONS.

Ex-Gov. W. D. Hoard, Ft. Atkinson, Wis.

I have always been an enthusiastic worker in whatever I did and enthusiasm is the only oil I know that will lubricate the machinery. One of my boys once complained of me, when I shook him—he said, "Father, why you shake just as though you meant it," and I think myself that it may be I carried it beyond just the true limitation, because of the energy of conviction which I have on all questions. I do not think in all the sixty-three years of my life I have ever been as much of a student as I am today; and I do not remember a time in my life when it has seemed to me that I knew less, or when what I knew has seemed so small and what I did not know, so big. This great dairy question has so many ramifications about it that it is like a great spider's web with a center and all these threads running into it. It embraces such a vast field of knowledge, study and information, and there is so much to do that I am in the fix of the old Irishman who, when they were talking to him about bacteria said, "Oh, Holy Mother, I wonder how any of my ancestors ever lived."

The question upon which I am going to talk to you today will be treated in a desultory manner and I shall have to depend upon the stenographer to catch me as best she can and give me a chance to look it over afterwards.

I have striven to correct my judgement on dairy questions by the most direct means. I do not want to be a man who is all theory, nor do I believe a man should be all practice, but with theory and practice he may possibly arrive at a just conclusion. And so I have invested in this creamery business with my son, a good many thousand dollars. We have one central plant in Fort Atkinson which cost $25,000 and we have other smaller creameries in the surrounding towns. Surrounding them, on the average, is a clientage of about one hundred farms, and the ten creameries handle the milk of

about 10,000 cows or about one thousand cows to each creamery. Each one of those farmers then, is affected directly by the creamery, for his good fortune or his ill. We have gone all through this matter of distrust, we have had that all fought over years ago and it is unavoidable to the existence of every creamery. Men have to learn their ways, and as the boy said who was set to breaking flax in the barn and who didn't make any headway, that he didn't believe he had "got the hang of the barn yet." It is always necessary to get the hang of the institution, and by and by men get to working in harmony with it and it goes along all right.

I think that every proprietor of a creamery ought to feel a conscientious impulse towards doing everything he can for the education of his patrons and to make that creamery conducive to their education. Every creamery is like a school house, it is an educational center. Now if the school does its duty and the patrons of the school do their duty, and the schoolmaster does his duty, at once you see everything becomes harmonious and the school is conducive to the advancement of civilization and knowledge in the community. If the school teacher is out of harmony with the school and scholars, this school does not become a useful center, but becomes a maker of discord worse than nothing. The creamery is like the school house the world over, in that it becomes an educational center and men come together and whether they want to educate themselves or not they must and will. Education is unavoidable, either right education or wrong, there is no such thing as men touching elbows with each other but what there grows out of it some sort of education.

The difficulty with all of us is ignorance. I don't mean to charge you with ignorance any more than myself. When I look back over my life and see where I have failed, I find in almost every instance it is because I did not know enough. Christ says, "The truth shall make you free," and I tell you that if you study the utterances of Jesus Christ along the line of philosophy you will find that there are many statements that reach far into the philosophy of human growth. "The truth shall make you free." Now what shall make you slaves? Error, wrong judgement, wrong suppositions of things makes a man a slave to himself, to his own error, to his own foolishness, to his own ignorance and to every line of misconception that crosses his pathway; and he is a slave to every other man. Now then, what shall we do to make ourselves free, how shall we get at the truth in our own mind, in our relationship to our duty and our business, and get at the truth of the thing itself?

Prof. Hills said this morning: "Don't distrust, but investigate." Get at the truth of the thing.

The creamery stands there as an educational center. What shall that creamery do for the promotion of the good of its patrons? I would have the creamery, I have been striving to do it in my own case and I have only been hampered by the inertia of the patrons—I would have the creamery issue every year a printed report, and that report should include these facts: First, the names of the patrons; second, the number of cows each patron keeps; third, the number of pounds of milk each patron furnished at the creamery; fourth, the per centage of butter fat that milk produced; fifth, the amount of butter made; sixth, the average price received for butter at that creamery for the year; seventh, the average price per hundred pounds of milk that those receipts called for; eighth, the amount per hundred pounds of milk each patron received; ninth, the returns per cow to each patron, in weight of milk and butter and money for the year.

It looks like a simple thing don't it? But if there is anything on earth the average patron will fight, it is his own enlightenment. I am not talking now about efforts on lines of theory, I am talking, as a fellow said, "Close down to where they live." I know men from actual business dealing with them, and I repeat it, if there is anything on earth patrons fight, it is their own enlightenment. Why do they fight it? Because they must take it first to see where their own mistakes are and every other man sees their mistakes too, and they are sensitive. What was the difficulty with these reports? We got them out and we raised a hullabaloo about our ears. The man who was stupid and careless, he did not study enough about his business to appreciate a good result, did not want that result made manifest to the eyes of his neighbor; he wanted to be treated tenderly; he would rather not know anything than not to be treated tenderly; and every fellow who was like unto him kicked up a rumpus and we have had rumpus after rumpus. But by holding on, by being patient, by never letting up, these fracuses have subsided and men begin to see the truth.

Every man's horizon is limited to what he can see. Lift him up and he has a wide horizon, and by and by you can lift him so he can see the relation of other men to him. Nothing is more common in this world than to see a man hold a cent so closely to his eyes that he cannot see a ten dollar gold piece behind it. The point of vision is a wonderful thing in giving us an understanding of our relations.

Now common sense is the great solvent of our difficulties in this work. When my boy was in the high school he had an

essay to write. The teacher told him to define common sense. He came to me and says, "Father can you tell me the meaning of common sense?" and I said "Yes, of course I can," and I started in, but I never was so brought up standing in my life. I studied a week and finally with the boy's help evolved this: That common sense is the widest understanding possible of the relation of common things. We live a life of common things and we do not live a life of uncommon things; it is necessary first to have the widest understanding possible of the relation of common things, and next to know our relation thereto, and then to have the ability to see. Raphael the great painter, was asked to define art in a single sentence and he spent a month trying to surround (as the saying is) the proposition, and he evolved this: "Art consists of the ability to See." Now stop and think about that a moment. Art consists of the ability to see. What did he mean? He meant if the mind's eye did not see the picture before it was painted, the hand could never paint it. Do you know that applies just the same to the making of an axe helve? If a man buys a piece of timber and if he does not see the axe helve clearly in his mind's eye, he will spoil the timber. It applies to the digging of a ditch; if the man does not see the proportions of the ditch clearly in his own mind it would only be a crooked gash in the ground. An Irishman once dug a ditch for me and it was so fine a piece of work I said "That is a ditch fit for a king," and O'Brien made me a polite bow and said, "Your honor, the O'Briens were kings once." That man came from one of the old families in Ireland; evolution and disorder had scattered the people, but they were kingly in their origin and the old man took a kingly pride in making a ditch and a good one.

If I could get men to see that — if I could see that bred in the soil of human character, and it should be in the character of a man's work.— I should be doing something to elevate civilization.

If a man will take pride in his work, pride in the character of his cattle, pride in the amount they produce, pride in the producing power of his farm, that man becomes an intelligent and manifest power. If that man takes no pride in his work, every day he inevitably takes a lower and lower conceit of his duty and the final results are as Mr. Whittaker said this morning about breeding down of cattle—it is a grading down, not up of the intelligence of the farmer. I can take you into communities where forty-two years ago I lived where the whole community was made up of old farmers, as fine specimens of men as this country affords. And today that community is in the hands of men absolutely discordant in character,

no such ability shown in farming as was done there forty years ago. What has caused this deterioration? It is the lack of that intelligent judgment which belongs or should belong to the farmer. The creamery can promote that and if the man who runs the creamery is a statesman and a good politician, if he is a broad minded man and can take hold of that community, the influence of that creamery upon the community in the promotion of knowledge and good fortune will be astonishing. My good friends, I have seen it worked out, I have done what I could to work it out in my own business. I have seen hundreds of creameries in this country where the patrons are examples of the remarkable influence of such determination. Therefore I say a creamery can be an almoner of good to every community if it will.

Now that report I told you about was a faithful exhibit every year of just exactly what these men have done. Start a man at ten cows that give 8000 pounds of milk apiece. He brings to the creamery 80,000 pounds of milk in a year. His neighbor looks the report over and says, "Well, I don't anywhere near come up to that, something is wrong," one man begins to look at the work of another, and the influence of these comparisons, one upon another, is strengthening in its effect.

Now the creamery can do other things; it can aid mutual cooperation. It is so hard to get the average farmers to trust one another. Prof. Hills struck the key note this morning. What does a trust mean? What do the great trusts mean? Just think of it. Men put their capital together, enough to buy up cables and countries and trust one another implicitly, while farmers with only $5,000 at stake distrust one another. Great capitalists form a trust in mutual defense against the world. You can learn a lot about this trust business, you can learn a lot about what it means; if you do not look upon it with suspicion you can see it is a force. These great trusts will be all right if they are conscientiously conducted, and the great lesson to be learned from the trusts is *trust*. If the farmers in every community would cooperate together and consider these questions what a great work they could do together. I have been trying to have the farmers cooperate in buying their feed together. I said, "Why can't you put your money in a pool and buy your bran?" You can start with the butter maker at the creamery. He can say, "bring in your money if you want a car load of bran we will order it," and finally we have got them in; now they cooperate don't they? By and by there is machinery to be bought and they ask "Why can't we make a pool and buy this machinery?" We go to an agricultural machine agent and say, "We want so

many plows and harrows and all that and then we find a difficulty; each one wants a different kind. As the old Indian said, it was a good thing people didn't all think alike, if they did they would all want his old squaw. We finally get them together, are all ready to say, this community wants so much of this and that and go to an agricultural agent and say, "How much will you charge for all this?"

And so I say to you, the creamery can promote the interests of the patrons in a variety of ways if only men will cooperate and be willing to trust one another.

I leave the question here for you to follow it out.

A Member—One of the worst things we have to deal with is the question of ventilation in stables.

Gov. Hoard. You have a practice in Vermont and New Hampshire of piling the manure under the stable and leaving it there the year round. I don't believe there is a man of you who would live that way over a receptacle of that kind and have it under your home. Have you any reason to believe that the cow's lungs call for a less pure air than yours do? And if you don't provide your cow with as pure air as you can, that cow is bound to suffer and you with her. How shall you ventilate a stable? Every stable should be as clean as your kitchen. You have to heat your stable with the animal heat of the bodies of your cows, you cannot go to work and heat it artificially. Prof. King, of Wisconsin Experiment Station, invented the best system of ventilation I have ever seen: Call this room a stable, eight or nine feet high and ceiled over head. About half way up the outer wall there is a register there or opening and a pipe that runs up even to the ceiling and an opening that comes in at the top. The cold air will come in there and strike the warm air up there against the ceiling and force itself through and against the warm air. The warm air will not sink down and go out and the fresh air comes in and through the layer of warm air. And then even with the floor all along behind the cows calculated cubically to be sufficient for the number of the cattle in the room, are registers a few inches above the stable floor, communicating with long galvanized iron pipes that go up through the roof and as the fresh air comes in, this foul air is sucked out at the bottom and goes out at the top. The foul air is constantly going out of the stable and the fresh air is constantly coming in and being warmed. The stable is at about fifty degrees.

Mr. Pierce. Did I hear you say where the out-let was?

Gov. Hoard. At the bottom, usually behind the cattle, if you face your cattle inward it will have to be on the wall.

A Member—Would you advise the four sides of the stable to be tight and with that ventilation?

Gov. Hoard. Yes, and with plenty of windows. These dark, damp stables you have in New York and Vermont, with only one window where there should be five, stables without ventilation, and men going along as unconcerned about it as though there was no God in Israel! I don't wonder Christ stood upon the mountain and said: "Jerusalem, Jerusalem, how often would I have gathered thee, as a hen doth gather her chickens under her wing, and ye would not." Do you know the progress and knowledge along these lines seems to me some times to be almost sublimely small and yet I can see progress.

A Member—Is this a patented system?

Answer. No sir.

Question. What are the pipes?

Answer. Galvanized iron according to the cubic capacity needed.

Question. For ten cows?

Answer. Ten cows ought to have 8,000 cubic feet of air.

Question. Has Prof. King published this system?

Answer. Yes.

Gov. Hoard. I want to give you an illustration Prof. King gave us at our last Dairyman's Convention. Go home and take one of your wife's two quart fruit jars, take a piece of lighted candle and set it into that fruit jar, then take a piece of rubber pipe and set it down beside the candle. Breathe two breaths into the fruit jar and see the candle go out. Just think of it, with two breaths of your lungs you have used up the oxygen. If you want to see the effect further, raise the candle up a little and breathe in and see it go out and see the jar gradually fill up with carbonic acid gas, until you get the jar full of foul air which is so heavy it will not pass out. Think of this stable with its ten or twenty cows breathing that foul air; and then you ask them to do good healthy work, while you deny them the chance, when with but little expense you could give them a chance. If you can change it this winter do it at once, for the cows sake, for your own sake and for your Maker's sake. I appeal for the Maker, as well as for the cow, for a man who has a reverent idea of his Maker, should carry it with him when he deals with His creatures. Put this kind of ventilation and just as much sunlight into the stable as you can. I am getting my plans completed and I will have as many windows in my new barn as possible.

Question. Do the cows face the windows?

Answer. Yes, they face the outside.

Question. Will the sun shine on them?

Answer. Part of the day.

Question. Is it good for them to have the sun shine into their faces?

Answer. I never saw too much sunshine for you or for me, or for our cows.

There is only one thing that objects to sunlight and that is a woman. I wish the dear creatures would only take more sunlight. You know that cabbages grown in a cellar are soft, without color, vigor, tone or flavor. Animal life is affected in the same way. When people in England and Holland call for white veal they put a calf into the dark and fatten him in the dark and the veal is white and the tallow is white. Let a calf live in the sunlight and the tallow is yellow. Sunlight on the ainmal is the source of color, and largely the source of heatlh.

Mr. Tinkham. In the matter of throwing the manure below the stable. What particular harm can come to my cattle when the excrement is frozen as it is in the winter?

Gov. Hoard. Why do you do it?

Mr. Tinkham. From laziness, chiefly. We did this partly to avoid the loss sustained when the manure is thrown out of doors. What is the danger from frozen manure under cows?

Gov. Hoard. From the ammoniacal exhalation. I know of no law of exception whereby the economy of cow life does not require just as pure air as does mankind?

Mr. Tinkham. Why is not the air nearly pure.

Gov. Hoard. There is a constant rising of ammoniacal exhalation. When you have a large mass of manure under a barn whether it be frozen or not, and there are times when it is not frozen — it seems to me you are in dangerous proximity to a large amount of dangerous excrement.

Mr. Tinkham. About that time we have begun to draw it out.

Gov. Hoard. Why not draw it out every day?

Mr Tinkham. It is too much trouble. I know it is not convenient and with my abundance of poverty and lack of means it would be impossible for me to do it.

Gov. Hoard. There are in my county very few men but what do it. I think you will hardly find in Jefferson County, Wis., a first class dairyman who does not haul the manure out every day.

Prof. Hills. The Board of Agriculture has advocated at its institutes the rapid withdrawal of the manure from the barn for at least the past ten years.

Mr. Tinkham. If I was going to keep an animal through the winter in the very best possible condition, I would not have it in a barn at all. I would give it all the food it wanted, and I would have a shed for it to go under, if it wanted, with plenty of out-door air. I don't believe there is anything that will give an animal constitution — and that is simply the

ability to resist hardship, as much as that would. And this is true in a broader sense. There is a family in my neighborhood the children of which go bare-footed until after snow comes, I don't know as you could kill one of those children if you were to try.

Gov. Hoard. In families brought up in that way every child dies that can die.

Mr. Tinkham. It is a good thing. It is just what it comes to, the survival of the fittest. It is true with us, physically and mentally.

Gov. Hoard. But we do not allow the cow to live in that way, we shut her up. Let the cow alone and let her have her range and she will take care of herself. She won't give much milk, but she will look out for herself,. You shut her up and if you shut her up you are in duty bound to exercise sufficient judgment to give her pure air, therefore you must provide her with ventilation, to let in good air and let out the bad.

Mr. Bronson. I would like to call your attention to the basement stable. Some of the worst ammoniated stables I have ever seen were some of the old stables where the manure was outside. It looks to me as though a well ventilated basement with the conditions our farmers have, is the best for them. How do you fix the stable floors so there will be no trouble?

Gov. Hoard. If you keep your stable at fifty you will readily see there must be exhalation. I would construct the bottom of my stable of cement, except where the cows must lie, there I put plank. The cows are always well bedded but cows will push that bedding away and leave bare places, so where they lie I put a non-conductor. This plank runs under them but just as soon as they step back they stand on cement, and behind them there is a slight gutter, not over two inches deep and in everything about it I try to make it absolutely impervious, I would sprinkle land plaster night and morning in there, first for the health of my cows, and second to save ammonia. You go to New York and pay for ammoniacal salts, say, sixteen cents a pound. Now land plaster costs me $1.60 a barrel and I believe it is worth two or three times as much as it costs to hold nitrogen in the manure until it is used for plant food. It is sprinkled in the gutters night and morning. Horse manure in the gutter behind the cows is spread as an absorbant and if I have not sufficient horse manure I gather about a dozen salt barrels full every year of road dust. My hired men go into the roads and gather up the dust and these barrels are carried into the stable and they stand there. It takes a little labor but what are we here for but to swap la-

bor for money. My cows are tied, each cow by herself. I would not use a stanchion for two reasons; one is the discomfort of the cow, and the other is, when cows are lying down, other cows step on their udders. My cows wear a leather halter fastened with a snap and ring. In front of them is a horse rack and it slants toward the cow. It is about thirty-eight inches from the floor. It is eight inches wide at the bottom and at the top it is two and one-half feet wide Now the use of the rack is to force the cow back when she stands. I nail a strip of two by three across the stall just forward of her hind toes. I fill the place with bedding, so when the cow lies down she comes up on to the dry bedding, when she gets up the rack forces her back. I have cows with white flanks, just as white in winter as they would be if turned out to pasture, and I can make the cleanest, purest milk I ever saw. My wife don't complain that the hired man has peppered the milk with manure before it came to the house.

A Member—They can't lay on the whole business?

Mr. Hoard. You don't understand me. The rack stands thirty-six inches from the floor. The cow comes right under it, she eats out of the rack. I can't explain it to you so you can see it. Write me when I get home and ask me to send you a good engraving of it and I will do so.

Mr. Smith. Gov. Hoard has been an old friend of mine and an old correspondent. I have received something like fifty-two letters a year from him for the last fifteen years in the shape of Hoard's Dairyman, the instruction which I have received from these letters has enabled me to achieve some of the success that I have gained in the years that have passed. It is by studying along these lines, following out the examples which have been laid down for me in these fifty-two letters, that has enabled me to branch out in the lines that he has suggested. It is for this reason that I own today the grandson of the cow he has spoken of here. I would like for the benefit of this audience a description of the special purpose dairy animal.

Gov. Hoard. I will speak just a few minutes along the line of such a cow, tomorrow, if I may be permitted.

President Pierce. Unless it interferes with the speakers tomorrow morning, we will consider it so ordered. We will now take a recess until tomorrow morning. The members will remain for the election of officers.

ELECTION OF OFFICERS.

G. W. Pierce of Brattleboro was nominated by Mr. Aitken of Woodstock to serve as president, seconded by Mr. Smith. Mr. Pierce was unanimously elected to succeed himself. Mr. Pierce thanked the Association for the honor of the second election as head of the Vermont Dairymen's Association. It is imposisble for me to serve you another year. I respectfully ask you to excuse me. H. W. Vail made a motion that Mr. Pierce be excused, and it was so voted.

Martin Clark of Williston was nominated for president by C. F. Smith and M. A. Adams of Derby was nominated by J. O. Sanford. Result of the ballot was as follows:

Whole number of votes cast,	48
Necessary for choice,	25
Mr. Adams had	27

And was elected president of the Vermont Dairymen's Association for the year ensuing.

Mr. Adams. This is one of the proudest days of my life to be elected at the head of the Vermont Dairymen's Association.

Mr. Adams very prettily thanked the Association for the honor tendered him.

Mr. J. C. Sherburne nominated Geo. Aitken for first vice-president and he was unanimously elected. Edward Gordon was nominated as second vice-president by Mr. Byington and was unanimously elected.

F. L. Davis was nominated by H. W. Vail to succeed himself as Secretary. Nomination seconded, and Mr. Davis was unanimously elected. P. W. Strong was nominated by O. M. Tinkham to succeed himself as treasurer. Nomination seconded and Mr. Strong was unanimously elected. Mr. Geo. Terrill was nominated by Mr. Bronson to serve as auditor, nominaiton seconded and Mr. Terrill was unanimously elected.

SALE AND TESTING MILK.

G. M. Whitaker, Editor New England Farmer.

Cities and large towns make a demand for sale milk. Consequently in a state located like Vermont, the sale milk interest must necessarily be a minority one, and though the state is exceptionally well equipped for dairying, the product of the dairies must be worked up into butter and cheese which for shipment are less bulky than milk.. It is therefore appropriate that the state should have dairy associations, and that these should give almost exclusive attention to butter and cheese making. But there is in the state a minority interest engaged in the sale milk business, and it is therefore also fitting that a small portion of the time at an occasional meeting of this sort, should be devoted to considering the dairy question from the standpoint of the sale milk farmer.

In your state ten of your larger cities and towns have an aggregate population of about 75,000, quite a proportion of these people must be supplied by the milkman, probably in most cases the man distributes what he produced on his farm.

Averaging many statistics, a pint per day per capita is the consumption of whole milk, so that the sale milk business in the cities and larger towns of the state amounts approximately to 37,000 quarts per day.

But this is not all. The city of Boston is reaching out towards Vermont for a portion of its milk supply, and has already tapped the state at three different points. A car runs through the southwestern portion of the state every morning, taking a number of cans of milk from farmers in South Vernon and vicinity. Another line enters the state at Bellows Falls, over which something like two carloads or approximately 6,000 quarts are shipped daily. This milk is in some instances drawn in wagons many miles to the railroad station for shipment by cars. When the car stopped at Bellows Falls one route from Chester was sixteen miles long, the driver starting every night at nine o'clock for his sixteen mile drive to Bellows Falls, picking up along the highway about one hundred and eighty cans. Since then, in order to save such a long drive, the car has started farther up the railroad.

The proprietors of this milk route also control a number of creameries along the line of that road between Bellows Falls and Rutland, which are run by them independent of any city

milk business, but which can be drawn upon at any time should a strike or climatic condition produce a shortage of milk in the city.

A third firm of Boston wholesalers run a car through New Hampshire to the Vermont line at White River Junction, controlling creameries in this state from which they draw occasional supplies of milk and cream when the supply in the market demands, and which they hold in reserve as a possible source of further supplies should the market require.

Any figures on Vermont's sale milk business must necessarily be somewhat vague and based on generalities, but I estimate that the direct sale milk industry in Vermont approximates 44,000 quarts per day, with a contingent interest of considerable more in creameries and cheese factories owned or controlled by Boston milk wholesalers as a possible source of supply for the Boston market in case of trouble. The value of this business is hard to estimate, because the milk shipped to Boston brings a much smaller price than that retailed by the producer among his neighbors, but 45,000 quarts at two cents per quart amounts to $900 per day, or $328,000 per year.

Very few people are aware at first thought, or until they have studied into the question, of the great difference in interest and motives between sale milk dairying and butter and cheese making. The butter maker is interested in producing the greatest amount of butter fat possible. He cares nothing about the quality of any individual quart of milk; but with scales, Babcock tester and multiplication table he figures on the total amount of butter fat which his cows will produce in a week, month or year. It is a good deal the same with the cheese maker. But when we come to the sale milk producer we meet an entirely different condition of affairs. Speaking in a general way—barring a few exceptions to be noticed later on—he cares nothing whatever about the quality of the milk, but looks only at the quantity. He is not engaged in producing butter fat but in producing quarts. He buys cows that will yield the greatest quantity. If he raises his own calves he breeds from the cows that are the heaviest milkers. This condition of things tends to develop by breeding and selection a race of animals which give poorer and poorer milk so far as total solids is concerned. Let a community which has been producing milk for a local creamery stop and begin the shipment of milk to Boston; and inside of two years the average milk produced in that place will decrease two or three per cent. in total solids.

Were it not for two things this tendency would continue indefinitely, how far I do not claim to be able to predict athough it would be extremely interesting as a matter of curi-

osity to ascertain how far breeding down in quality of milk can be carried.

One check on any continued deterioration would be the consumer. The average consumer is extremely ignorant regarding the composition of milk and is too much inclined to accept anything and everything as milk, even the more intelligent and critcial cannot be expected to detect a variation of only one or two per cent. in total solids. But there would come a time when the milk would be so extremely poor that even the most ignorant consumer would remonstrate, and the milk dealer, in order to hold business, would be obliged to sell milk of a better quality.

Another factor in the line of checking a steady deterioration in the quality of milk giving cows, is the state law, which steps in and says "Thus far shalt thou go and no further." This accomplished in nearly every state in the union by a statute standard. A number of states in establishing a standard provide that milk below the standard shall for purposes of enforcing the law be considered as adulterated. New Hampshire and Maine provide that when milk is found of less than standard quality it shall be *prima facie* evidence that it has been adulterated, but Vermont and Massachusetts have laws prohibiting the sale of "milk not of good standard quality," and then prescribe by statute what that standard shall be. Unless the Vermont law has been changed lately it is 12½ per cent. of solids except in May and June, when it shall not be less than twelve per cent. The Massachusetts law has been tinkered with until we have a thirteen per cent. standard six months of the year and a twelve per cent. standard six months. In nearly all of our prosecutions in Massachusetts, even when milk is doubtless adulterated, we make out our complaint for the sale, — or possession with intent to sell — of "milk not of standard quality." In court it is much easier to prove that milk fell below a standard of quality than to prove that it was adulterated.

These laws establishing an arbitrary statute standard for milk are criticised by some, and I am free to admit that they are open to objection. The ideal way would be for the consuming public to be so intelligent that individuals would be willing to pay for milk what it was worth according to its quality, fifteen per cent. milk selling at one price and ten per cent. milk at another price, all milk being marketable providing it was what it purported to be.

This is an ideal to be hoped for, the same as universal honesty and temperance. But I do not believe that it would be wise to open the prisons and discharge all of our police and constables, because mankind ought to be better, and on sim-

ilar grounds I oppose doing away with a statute standard for milk because there is an ideal that is better. It seems to me that under the circumstances the standard is a good thing. It guarantees to the consumer milk of average quality and in doing so increases confidence and hence creates a larger demand. It takes away from the producer the competition of a lot of low grade stuff; and the broader interests of a more dignified, progressive agriculture are promoted by putting a stop to the continued breeding of cows that would give quantity rather than quality.

There is a sentimental kind of point sometimes made to the effect it is unjust to fine a man for selling milk just as the cow produced it, and a shrewd lawyer gifted with a good flow of language, can ring the changes on this in a court room with much effect. It seems to me, however, that the point is more sentimental than practical. because every producer knows what the law is. He has the means of testing the milk of his cows and of knowing what he sells; and if he deliberately sells milk of less than standard quality, or deliberately owns cows producing low-grade milk, why should not he be punished as much as if he watered the milk through the medium of the pump. The consumer is defrauded by getting less than he pays for in either case, and it seems to me that the transaction is equally reprehensible, whether the pump or the cow is the means used for reducing the quality of the milk.

The statute standard is of great assistance in preventing the sale of milk that is actually adulterated, because where milk is not largely adulterated with added water, it is difficult to tell whether it is the milk to which water has been added, or low grade milk just as the cow produced it.

I said the producer has the means of testing the quality of the milk he produces. Let me explain. The Babcock tester is now well known to the butter maker, and its advantages to the butter making dairyman have been emphasized in no exaggerated way. But sale milk producers and dealers do not yet realize the possibilities of the Babcock for them. Fat is the element of milk that governs the amount of total solids. The solids not fat are comparatively constant, the fat varying greatly. What variation there is in the solids not fat is in the line of an increase with the amount of fat. The more fat the more solids not fat. Milk of twelve per cent. total solids should have about three per cent. of fat. Milk of four per cent. fat will have a strong thirteen per cent. of total solids. From this you readily see that a milkman with a little two-bottle tester can obtain a very intelligent idea of the product in which he deals.

While there is need of great accuracy in the use of the Bab-

cock in creameries and cheese factories where the money returned to the patrons is to be decided by the arbitration of the Babcock, such absolute accuracy and such painstaking care in all of the details of the manipulation are not necessary on the part of the man using the Babcock test to throw light upon the mysteries of the sale milk business. If he finds three and one-half or four per cent. of fat in the neck of the test bottle he knows that there is at least as much as that in his milk'.and if his work has been inaccurate it has been in underestimating rather than in overestimating the quality of his milk. He has made a test which is sufficiently accurate to enable him to have a clear conception of the quality of the article in which he deals.

Those who oppose a statute standard for milk portray the milkman's burden as a constant wrestling with a great mystery and uncertainty, with the constant danger of being pulled into court. This is all wrong. There is no mystery or uncertainty about the quality of the milk, and no sword of Damocles hanging over the milkman's head. The milk of different cows varies sometimes as much as from ten to sixteen per cent. of total solids. The milk of a single animal varies from day to day but usually not over one per cent., going at once back to the average. But the mixed milk of a herd of cows with good treatment will be extemely uniform and vary but little from day to day the year round. Many experiment stations and private dairymen have found that the mixed milk from the same animals varies hardly more than .2 of one per cent. the year around.

The notion that food influences the quality of milk dies hard. When milk runs low in quality the Boston milk contractors even now sometimes write to the producer that he must feed more grain, but this will not help the trouble. Last winter's legislature in Massachusetts dropped the Standard for September from thirteen to twelve per cent. in the foolish and unscientific argument that September is the month in which corn fodder is fed to a great extent, and that milk of average quality cannot be produced on corn fodder. Such a statement was manifestly ridiculous and no just ground for changing the standard.

Climatic conditions may change the quality of milk temporarily. Your own state experiment station showed at one time that when the daily temperature of one summer was plotted on a sheet of paper, and the daily analysis of milk of a herd of cows was also plotted on the same sheet, the lines representing these two conditions were almost exactly the reverse of each other. In other words when the thermometer registered up in the nineties and the weather became enervat-

ing the quality of milk dropped correspondingly. When the weather got back to ordinary comfortable summer heat the quality of milk rose to its average. This does not interfere with the statement recently made that the mixed milk of a herd will vary very little from day to day, for that statement presupposes conditions under which the animals do not suffer from the stress of temperature, either heat or cold. The quality of milk may change with the season if it so happens that the herd has a great proportion of cows that are drying up at one season and of new milch cows at another. Barring the points above made, if the milk is of less than average quality in total solids, the fault is with the animal, and nothing can be done to raise the quality of milk of such a herd but a change of animals. In a herd however, it may be that a few giving large quantities of milk of less than standard quality may be very useful if there are others giving milk of higher quality, as the mixture will average to be about right. The Walker-Gordon company sell milk in Boston under a guarantee of four per cent. of fat. Their herd, however, is not a collection of choice thoroughbred animals, but a picked up herd of grades of all kinds, some strains of blood furnishing richness and others quantity. In this way they have a herd producing a maximum amount of milk and have no trouble whatever in keeping the quality up to the guarantee. If the daily tests show a tendency of quantity to decrease and quality to increase the judicious swapping of a few animals will correct this tendency. The same is true if the tendency sets the other way.

Some of the current literature of the day has been devoted to discussing what is the greatest event of the century. While different things have been mentioned and their claims to this prominence been argued with great force, it seems to me that nothing can be mentioned which can take precedence over the discovery of the principle of bacteriology. This has robbed surgery of its terrors, has put such diseases as diphtheria andt yphoid fever under control, curtailed dread consumption to a great extent, and has been of great influence in many industries of the world. It has transformed the whole basis of the manufacturing of beer and butter, and been of great service in other ways. In short, it has reduced sickness and suffering, it has enhanced economy, and increased the comforts and luxuries of the human race. It has been of immense importance in the sale milk business. We have learned that milk is a medium in which contagious diseases may be spread, and consequently have been enabled to increase its healthfulness by taking precautions which this advance in science has placed before us. We have been able by this knowledge of bacteriol-

ogy to enhance the keeping qualities of milk and hence make it an article which can stand longer transportation than formerly, thus bringing Vermont milk as a possibility for the Boston market. It is now known that the decay or souring of milk is caused by the bacteria in the air which gets into the milk, that in the air of a filthy barn bacteria are much more numerous than where cleanliness prevails; that the first half hour of the life of milk is the critical time with it. Hence, if milk is drawn under as cleanly conditions as possible and immediately cooled, it will keep a long time and can be transported many miles without deterioration. Professor Conn, a well known expert in dairy bacteriology, says that in many instances the milk supply of large cities which has been shipped long distances is of superior quality, because increased precautions have been rendered necessary.

These bacteriological investigations have led in many instances to the establishing of fancy dairies in the vicinity of large cities for the production of milk under ideal conditions, for which a fancy price is received. In these stables the most scrupulous cleanliness prevails. Barns are carefully swept and kept as clean as any house. In some instances the walls are of tile so that they can be daily washed with the hose. Utensils are thoroughly cleansed and sterilized. (And right here allow me to say parenthetically, that the common, every day farmer should not be scared at the new-fangled, high-sounding word, "sterilization.") Sterilizing is merely heating to such a degree as to kill all forms of bacterie, and is nothing more or less, so far as milk utensils are concerned, than the common, old-fashioned word of "scalding." Every utensil connected with the dairy should be thoroughly scalded.

In these fancy dairies the men employed are required to practice great personal cleanliness, and are expected to wash their hands before milking as much as before going into the house to eat. They have special clothes of white duck, kept scrupulously clean, in which to milk. All this may seem to you over much fuss and feathers and may be impractical on the everyday farm, but there is a lesson taught in the scrupulous cleanliness and attention to minute detail in these fancy dairies which can be applied to greater or less degree with profit in every dairy.

Turning to the future, two things suggest themselves as to the needs of the sale milk business. The first is studying the cost of production. This has been emphasized repeatedly at these meetings from the standpoint of the butter maker. It has been shown by Governor Hoard what a vast difference there is in the average maximum and minimum production of cows making milk for butter, and what a wide variation there

is in the income from these butter cows. All these facts apply with equal pertinency to the sale milk producer. He must study to make the milk cost him the smallest amount possible per quart. If one cow will produce fifty per cent. more than another on substantially the same feed, and with no more outlay for care and shelter, it stands to reason that the cost per quart of milk from the cow of heavy production. will be much less than in the other case. Consequently the profits from such a cow will be a great deal more.

A second thought is that in the good time coming milk will be sold according to its quality which will be guaranteed by the producer, an article of fifteen per cent. total solids commanding a price fifty per cent. above that of milk of ten per cent. total solids. This time is a long way distant in the future. Although in the case of some individual dairies selling milk directly to consumers, the ideal has been approximately reached already, for supplying a large city like Boston, it is at present impractical. Still, it is an ideal which we should face. I re-recently heard a reform lecture in which the speaker gloried in the fact that he was an idealist even if his views were impractical. I cannot agree with such a position. I believe in ideals, in something to look forward to. But even if the full consummation of the ideal may be unattainable at once, it must be something that we can work for, that we can in some degree approach. Such an ideal means progress, and that should be the watchword of everyone, whatever his occupation or profession.

Gov. Hoard. I would like to elucidate a little further if I can, Prof. Hills, in regard to the increase of the richness of milk under falling temperature. The proposition I understood you to make was that in your investigation you had found that the ratio of fat was inverse with the temperature, that as the temperature, became high the fat decreased, and as it became low the fat increased. In cheese making we first discovered this years ago, that in extremely hot weather it took more pounds of milk to make a pound of cheese. As a rule fat increases as the weather grows colder but this other thought should be taken with it, that is, that the action of undue cold or exposure upon the mammary functions is to shrink, the action of warmth is to relax.

My wife told me more concerning these maternal functions than all the books and treatises in the world. I will recite an incident to show you what I learned. When my youngest boy was a babe my wife and I were riding on a very cold day, she took a sudden chill and her motherly instincts were aroused at once. She said: "I am so sorry I have got this chill." I was interested in her statement as a mother, for I

was quite a student along these lines, and I consulted her a good deal. She was a mother, and I could question her concerning the mother that I could not question. I said: "My dear, why do you reget having this chill so much, what are your reasons?" She said, "It means so much less for the baby." I said: "Less for the baby?" "Yes." "Well, what will you do now to restore this shrinkage?' "Why!" she says, "You ought to know what I will do, when I get home I will try to get warm, will take warm drinks." "This taking warm drink will incease the flow, increase the milk for the baby?" "Why of course, any woman knows that." I came home and I went into my stable and I went to experimenting with my cow. I turned her out in the cold, I noted her shrinkage, and I commenced to give warm water and I noticed that as the cold shrank the flow of milk, warm water helped her back again.

I published to the world, I think, about the first, my experiment of warming water for the cow, and I thought I was an almighty smart man, but when I came to look it over, there was not an old woman in the country who had not known about this thing for hundreds of years. Now my observation in this particular is this: Let every man walk with uncovered head in this pathway of nature and let him remember that this great function of motherhood is one that is found in all the animal creation, and let him above everything else consult his wife, and let her motherly judgement and sense of cleanliness determine his action very much in his management of the bovine mother.

W. H. Gray. We put in a steam boiler in our house cellar over ten years ago for the purpose of warming the water for our cows. We got the apparatus in operation about the first of January, and warmed the water for our cows to about sixty degrees. We supposed we were doing a fine thing. In March we could not get steam through to the barn and we had to water our cattle with the water that came from the spring, which probably was as cold at that time as at any time. We make our butter and salt it by weight, every churning was weighed and salted. We found that shifting from this warm water directly to the cold did not influence the product of butter one particle as we could detect by scales. We concluded that if we didn't get any more butter it didn't pay to warm the water and we stopped then and there.

Gov. Hoard. I don't think it pays any man to warm water for his cows if he has a stable that is warm enough so the cows drink without discomfort, but if the cows go out of doors and get chilled, or drink from an ice cold brook, any man who

knows anything about the secretion of milk must know it would tend to decrease the flow.

Mr. Tinkham. I would like to ask that gentleman (Mr. Gray) if the water froze in his stable.

Mr. Gray. No sir.

Mr. Tinkham. Did you notice any diminuation in the flow of milk?

Mr. Gray. We thought when we commenced warming the water that we got more milk.

Mr. Tinkham. Didn't observe any falilng off when the steam stopped ?

Mr. Gray. No sir.

THE DAIRY TEMPERAMENT IN COWS.

Gov. Hoard. (Speaking with charts) It is a difficult thing in the short time allotted me so to condense what I will have to say as to get in the truth ahead of your appetite as it is now nearly twelve o'clock.

Here (pointing to cow on right) is a representative of the dairy cow drawn for publication in the "Dairyman" two years ago, outlining in her, as near as we could, as man's judgement is, the structure and physicial form and shape of the dairy cow.

Here (on the left) is a representative of a Shorthorn heifer which gives you a fairly good idea of the formation of the beef type. It is very evident that nature follows a very clear and distinct line, and that she creates form suited to function. I spoke of this yesterday when I referred to the grayhound as being constructed for speed. The grayhound is built for speed, so is the race horse; that is his function and the way he is built has been taken advantage of by the breeders of race horses and breeders of grayhounds. But I will say the average farmer all over the United States has altogether too crude ideas of the value of breeding. The sort of cows he produces makes me think of the way the Frenchman called for an old fashioned flip. He said "I want some Jacob." "There is nothing sold called Jacob," said the bar keeper. "What is it like?" He said: "You put in the brandy to make him warm, and the water to make him cool, the sugar to make him sweet and the lemon to make him sour." "Oh," the bartender said, "that is flip." "Well then bring me some Philip." You will find the average farmer breeding cattle along these lines, breeding in Holsteins to give quantity, Jerseys to make more butter fat and Durham to make beef. The average farmer of the United States has so misunderstood the laws of breeding

that he has produced a cow that does not make butter enough to pay for her keep.

I am a dairy cattle man, though I am a student of beef types. I am a breeder of dairy cattle and I do not know nearly as much today as I thought I did thirty years ago, but if one thing is fixed in my mind it is that if I want a race horse or a dairy cow I must breed *straight* from the race horse or dairy fountains of blood. One illustration to show you the power of heredity we have to deal with. A fox hound is bred to follow fox tracks. That fox hound will run over thousands of bird tracks and never know it; but the moment he strikes a fox track up comes his head and you will hear the deep-toned cry in answer. A bird dog with nose equally sharp will pass over a hundred fox tracks and never know it, but the moment he strikes the track of a bird he is arrested, everything at halt, the dog is rigid in answer to the purpose for which he was bred, "I have found it, I have found it." "What have you found?" "I have found what I was bred to find." There is not a boy in all Vermont foolish enough to go out hunting foxes with a bird dog, or to go hunting birds with a fox hound, or hunt either with a bull dog, but his daddy will go plunging around hunting for butter in a beef cow. What is the matter? He is not in touch with great economics of the question. He has come down through a general purpose notion which is taking the best profit out of his pocket. His necessities are calling constantly for an increase in the power of production, and he must turn away from this old fashioned general purpose influence if he is going to get what he needs; he must begin to breed and fashion his animal as the economy of the times demand. Look at this dairy cow, see how she is built. Look at this one (pointing to the beef cow on left) a square block with a leg at each corner. Each cow comes down through long years of inherited temperament, and by temperament we mean a strong, over-ruling predestination of heredity which takes food and turns it into a certain channel for a certain product. The beef cow eats food and turns it into the flesh-making channel. The short horn cow may give a fair amount of milk, but undertake to crowd her a little, feed her a little more food and at once you will find the dairy temperament weakens and the cow begins to put on flesh. Therefore you have to start with the *first thing* in breeding dairy cattle, you must start with the dairy temperament. You cannot feed fat into milk, you cannot determine your butter fat by the food you feed. You can determine the quantity of milk, but there are many thousand farmers who cannot believe that they must first determine the character of milk in the cow by breeding. Temperament has made this cow

of different shapes. *Temperament comes first, function next, and function decides the form.* Whoever heard of a general purpose mowing machine, or sewing machine ; whoever heard of a general purpose machine of any kind ? And the reason we get so low results in dairying is that farmers have been breeding general purpose cattle, and they have got 125 pound cows and 150 pound cows. Here and there among these cows a man may find a very good animal, but the heredity is such that when you attempt to breed her you will find a disposition to put on flesh when you want butter fat.

A man in my town put a Short-horn sire at the head of a herd of cows which made from 250 to 275 pounds of butter apiece and in about eight years he had run down from 250 pounds to the cow to 165 pounds, and the man sorrowed and said, "these years have I wasted." And he prayed "forgive me oh Lord, for my ignorance of thy laws." By his side was another man who had a herd of grade Short-horn cows and he said, "I cannot make my cows produce over 150 pounds of butter per cow ; what would you advise?" I replied I would advise you to put the finest Jersey bull at the head of your herd that you can find, take the best of those daughters and bred back to the sire." He was surprised and said, "breed them back to the sire?" I said, "certainly ; there is no harm in inbreeding cattle to a certain extent ; with men it is different. Cattle have not taken on way back certain unnamaable diseases. Hahneman, the great German physician, states that modern scrofula is ancient syphilis, so you see that inbreeding with men, it does not mean the same as with cattle."

I said "breed back the daughter to the sire ; you have the sire in the grand-daughter twice, and the daughter only once." What was the result ? The grand-mothers made but 150 pounds of butter ; the grand-daughters made 327 pounds of butter. That was all in the line of my observation, and shows the effect of intelligent breeding and comprehension of the laws of heredity upon that man's fortune, and I say you may verify this in every direction.

Now I will go through this rapidly, I want to speak of two things, and I will try and confine myself to those two things. You see this animal is of peculiar shape. I will speak of Constitution. Right at the naval is the place I study the constitution of the animal. We must have constitution in our dairy cattle. What is constitution? It is the ability to stand up and endure. Constitution is not capacity. You have any number of cows with large capacity who cannot endure their work, you have a number of fast horses who cannot stay on the track and endure their work. I first got on to this idea by seeing an English army surgeon in the Civil war examine a

man who had been drafted. The man was a fine looking specimen but he rejected him, I asked him. "Why did you reject that man?" and he replied, "He has no constitution." He stated that strength of build was no indication of constitution.

The man was stripped and the doctor said : "Look at his abdomen." I saw there was something lacking, I didn't know what. He said to me: "Here is the finest indication of constitution. Constitution is implanted by the mother and if the babe is born with the umbillious thin and spindling every physician knows it will be very hard to raise that babe, but if on the contrary the umbillical cord is full and large, showing that the foetal circulation has been perfect the little fellow has been started right, he may not be strong in one sense, but he is vigorous and comes into the world with a whoop,and that baby is not easily thrown off his feet, he is not easily cast down. He has an enduring constitution. This is the law running through the animal creation." I said: "Doctor, have you ever carried your observation any further?" and he replied, "I have with horses." I went to studying it, I took it up with cattle, I wanted to know if I was right, and I say to you I have never been deceived once in my life upon the constitution of a cow. The minute I feel of her abdomen and press upward and against the abdominal walls, and find them strong, heavy and thick, I know she is an enduring cow, and that her mother started her right, that she has got a strong constitution. It is no indication of capacity but it is an indication of sufficient constitution to stand the work of capacity and not go down with disease.

Now one or two things more. Here you see the head of this cow, you see the full eye, and indications here of a large brain power. The full eye makes the dishing face ; then you have a strong back bone and this is one of the most important things in determining dairy cattle. This high rise just back of the hips is the pelvic arch. Here is a picture of a cow that Mr. Aitken brought in here yesterday. I want you to note how high the pelvic arch is in that cow, the value of it is to indicate the strong structure of the back. Why is a strong structure of the back necessary? The dairy cow carries large weight, she carries much food and drink ; she is making a lot of milk every day and she must have a strong back because the back is the bridge between the two piers, the legs. She carries a great deal more than the beef animal. And every day she makes a heavy draft on the nervous system, as every woman on earth knows—although every man does not know —that the mammary function greatly affects the nervous system. It is recorded in books that mothers have been thrown

into paroxysms of anger and reached such a condition that their milk produced spasms in their babies. These things are traced back to the nervous system, and the udder here is tied to the brain. Insanity in women is often due to derangements of this character. The action of the udder is a mammary function, it is united with the womb by a net work of nerves. Here you have a marvelous piece of machinery. That nervous supply must be connected well with the structure of the back and brain, and that is one of the first things I look for: Is the cow well supplied with abundant nervous strength and power? If she is not I know she is built above and beyond her power to endure. She must have a strong constitution and abundant nervous power to do her work.

The udder is a nerve organ, a mass of cells; it is actually producing the milk as you milk it. As you sit down and milk, the udder is filled with a fluid but it is not milk, only then does the nervous process and the action of the sympathetic nervous system begin to operate and that fluid to transform into milk. Many men have noticed a peculiar phenomenon connected with the cow. The cow will hold up her milk; put a calf to her, let her feel the mouth of the calf and she gives down her milk at once. The sympathetic psychological flow from the calf to the mother is seen at once. The milker is often a very poor substitute for the calf. The moment the mouth of the babe touches the breast of the mother there is established the psychological circulation between the two and all the functions set to work in harmony with their purpose. What does it teach us? It teaches us that the man who sits down to milk this cow should establish sympathetic relations with the cow.

Let me tell you something of a Jersey heifer I have. She is a grand-daughter of a famous old bull, Ike Felch. I bought his last daughter, in 1885. She proved to be a wonderful cow. She aborted her first three calves but had no trouble after that. She would make me 600 pounds of butter a year. She died when ten years old with a broken hip. Her last daughter I have today. This Jersey heifer brought me a calf the 10th day of last January. I bred that heifer to her own brother in order to save twenty-five per cent of the blood of the old bull in the resulting heifer, and I want to tell you what that two year old heifer did last year.

I commenced testing her on the 10th day of January — the calf was dropped the 6th — and she gave me from the 10th day of January to the 12th day of November 6794 pounds of milk with her first calf. The average test for the year was a little over five per cent — that made 396½ pounds of butter from a two year old heifer.

Question.— How did you feed her?

Answer.— She was fed gluten, corn meal, bran and about a pound and a half of oil meal a day, except in summer when she came to grass, and then for about two or three months she was fed daily about four pounds of bran with her grass every day. That cow has brought me a heifer. Her grandmother was a wonderful cow giving 600 pounds of butter a year. Now can I afford to take this grand-daughter and breed in a little Holstein to make quantity, and a little Durham to make flesh? Oh, no, I can't afford to do it, but I have taken advantage of the tendency of nature to repeat itself in a straight line by inbreeding and I must not impair that power.

I said some time back that I would confine myself to two things. Constitution was the first, the uddershape the second. In selecting your sire pay especial attention to the placing of the rudimentary teats. They should be wide apart lengthways of the body, that makes a square udder, and they should be of good size. If the teats of the sire are placed close together and in a heap, that makes a peaked udder that you don't want. Pay attention to this and you have done something for yourself in the resulting heifer.

You will find any number of men who will purchase a bull by the outside look of him, they tell you they can't tell why but he suits them. It will pay to look *into* him a little more.

The dairy farmer must read more and study more on this matter of producing a profitable dairy cow.

THE LARGER PER CENT OF PROFIT.

By W. D. Hoard, Editor Hoard's Dairyman,
Fort Atkinson, Wisconsin.

Two years ago in figuring up the difference in the profits of two patrons of the Hoard creameries, I was particularly struck with what was to me a new view of the relation between gross return and per cent of profit.

One patron received for the year $65.68 per cow in cash from a herd averaging nineteen cows. Another received $35 per cow. Both had skim milk returned to them. It cost the first man $35 per head to keep his cows, per year ; it cost the second man $30 per year to keep his cows. The first man received $30 in excess of the cost of keeping, the second man received $5. The gross receipts of the first man were not quite 100 per cent more per cow than the first, but his profits were 600 per cent greater.

What were the causes that lead to this difference? The difference was in the men. The owner of the best herd was a student of the dairy business, the dairy cow and dairy literature. He kept his mind open to the reception of the best ideas he could get. He bred and fed the best cows he could get. His herd was of his own rearing.

The second man did not believe in any of the ideas practiced by the first man, did not believe in his kind of cows, his kind of care, feed or anything else.

The first man made 60 per cent more profit than the other. Was this not worth striving for? Is there not also a good deal more pleasure, saying nothing of the profit, for the first man in the business than the second? It is the per cent of profit not gross returns, that tells the true story.

Here is another illustration of the fact that it pays a handsome profit to strive to improve in our understanding concerning the management of cows. In a creamery near my home, while looking over the returns of the patrons for the month of May last, I was struck with the lesson they taught. Taking fifteen of them as an illustration, we find these wide dfferences of profit:

No. 1 delivered 9,552 pounds of milk ; yield in butter 4.71 ; dividend, 63 cents per 100 of milk. Average dividend of the creamery for that month, 61 cents per 100.

No. 2 delivered 17,270 pounds of milk; yield in butter, 4.78; dividend, 64 cents per 100.

No. 3 delivered 7,039 pounds of milk; yield in butter, 4.93; dividend, 66 cents per 100.

No. 4 delivered 2,049 pounds of milk ; yield in butter, 5.37; dividend, 72 cents per 100.

No. 6 delivered 8,182 pounds of milk; yield in butter, 4.88; dividend, 54 cents per 100.

No. 7 delivered 2,734 pounds of milk; yield in butter, 3.81; dividend, 51 cents per 100.

No. 10 delivered 6,230 pounds of milk; yield in butter, 6.20; dividend, 83 cents per 100.

No. 12 delivered 13,137 pounds of milk; yield in butter, 3.89; dividend, 52 cents per 100,.

No. 14 delivered 7,085 pounds of milk; yield in butter, 6.12; dividend, 82 cents per 100.

No. 15 delivered 10,567 pounds of milk; yield in butter, 5.01; dividend, 67 cents per 100.

You have noted the wide range here in the returns per 100 pounds of milk. You have noted, also, that some of the patrons who brought large amounts of milk received the highest dividends. The lowest dividend per 100 pounds of milk was No. 7. He delivered only 2,734 pounds, and he received only 51 cents per 100. The highest was No. 10, who delivered 6,230 pounds of milk and received 83 cents per 100. The butter from each herd sold for the same price, yet one man recieved 32 cents more per 100 pounds than the other, and furnished considerably more milk.

What about the two men. No. 10 is a bright, intelligent, reading man. He is not afraid to spend a few dollars for a registered bull to put in his herd. He has been grading up his cows and grading up his mind and judgment for several years. If there is a dairy convention or a farm institute within reach he attends it. His table will show the best dairy literature in the land.

No. 7 is a man who sneers at the cows of No. 10, at his books, dairy papers, and registered bull. He says all these things are humbug. One man makes money at every turn, the other shuts his eyes, ears and mind and keeps cows at an absolute loss and don't know it. The first man is going ahead, the other running behind. The difference of 32 cents per 100 in milk represents the value of putting brains, mental effort, into this business of keeping cows.

That man deceives himself fearfully who thinks he is saving money by not spending money and time, to know all he can concerning the cow. If we are going to the expense of keeping cows, caring for them, milking them, and all other expenses, we are foolish indeed if we do not work as far as possible towards two things ; a better judgment in ourselves

and a better cow. If we improve our judgment we must keep posted on the experience of other men. To get this we must either visit such men or read what we can concerning them.

If we improve our cows we must do it by breeding first, and by rigid selection and good feeding afterwards. We cannot increase the capacity of the heifer over the mother unless we find for her a father that will convey to her superior dairy capacity. We must breed in more dairy blood if we expect larger dairy performance. I know of no other way. No man that I ever saw has increased the capacity of his cows generation after generation, bringing them up from 125 pounds of butter per cow to 300 pounds, as hundreds have done, and done this by breeding in the same old general purpose channels. If he secures an improved heifer, he must breed in more and better dairy blood than the mother has. To get this blood he must have recourse to the improved dairy breeds.

If you breed up scrub horses either for racing or draft purposes, you must draw from the race or draft fountain in the sire.

The law of heredity is what you take advantage of. It is as clear as the multiplication table, yet I have seen men who wanted to say twice two makes three, or five, just as it suited their purpose. They were simply deceiving themselves. They are not the men who get 600 per cent profit, or 32 cents per 100 more for their milk than their fellowmen.

Some men, yea many men, say "this is too fine thinking." But it is none too fine for profit. We are dealing with fine principles, and course thinking will not do. An Arkansas man was asked why he did not put a glass in his windows.

He thought that was too fine thinking, and replied "I reckon the sash will keep out the coarsest of the cold." Remember, the dairy farmer is a manufacturer. The cow is his manufacturing machine. She must be constructed to suit her purpose and his profit. It is our duty to know and practice the finer economies in constructing the cow and in her management if we expect the larger per cent of profit.

Here is one more hard fact to illustrate the loss that comes to men who persist in thinking that they don't need sound dairy knowledge and good cows to do business with. During the summer of 1898 the Kansas Agricultural College made an investigation of the patrons of the Meriden Creamery to ascertain the income they were realizing per cow for milk sold to the creamery. The poorest cow averaged $7.54 annually, and the best one only $42.09, making a difference of $34.55 per cow. Taking the poorest five herds, the average per cow is $9.44, and for the best five only $33.74, a difference of $24.30 or 257 per cent. Where records have been kept, it has been

found that it takes from $20 to $30 to pay for keeping a cow in Kansas. It will thus be seen that as far as milk is concerned the cows from the poorest herds are running their owners in debt. the only redeeming feature being the value of the calf produced. These figures illustrate very clearly the need and likewise possibility of materially increasing the income from the dairy cow.

The above is quoted from Mr. D. H. Otis of the college, who made the investigation and who furnished me the above figures. I would be willing almost to guarantee that not one of those patrons believe that it would pay him to subscribe for a dairy paper costing him two cents a week, or buy Gurler's American Dairying, a book costing but $1, or spend money or time in making themselves better posted. There are thousands upon thousands of men in the country today struggling along under such a load. What makes it worse is that they will not believe that it will pay them a splendid profit to know more about this business called dairying, about this animal called the cow.

I could furnish you with thousands of examples of men who started just where these men are, but who recognized at the outset that the first great necessity with them was to put themselves in communication with dairy knowledge. Today they are the proud possessors of herds of cows averaging from 250 to 350 pounds of butter per cow. They have come up out of great tribulation, but they have put light in place of darkness, and that has brought them hope in place of discouragement, riches in place of poverty, ownership instead of debt and profit in place of loss.

I would say to the man who is keeping cows; you must be your own schoolmaster in this business, but you must be teachable. You must fertilize your mind with the best accepted dairy truths. The most teachable man among us, the man who is willing to spend time and money liberally for more and better knowledge, is invariably the man who knows the most and who is doing the best with his cows. It don't pay to be indifferent. It don't pay to wrap ourselves up in a thick cloak of conceit. The facts and the figures are against such men. To such men, and oh, there are such a host of them, I would further say: Think about this matter of self-improvement, think about this matter of a better cow; don't begrudge the small sum it costs to put better ideas and better judgment in your minds and better dairy blood, feed and care in your herd, for only in so doing can you save yourself from loss, or find the larger per cent of profit.

Two Kansas dairymen sent milk to the same creamery in 1897, one receiving $12 for the milk of each cow, and the oth-

er $45. The one receiving $45 for the milk of each cow raised his calves on skimmilk and sold them at weaning time in the fall for an average of $18 each, giving an income from the milk and calf of each cow of $63. At this rate a herd of only twenty cows would give an annual income of $1,260 cash.

Here is an instance with two men with the same sky above them, the same earth beneath them and the same creamery before them. One received 525 per cent more in gross product than the other, but that is not all. One kept cows at a profit and the other at an absolute loss. What do you suppose caused the difference? One man accepted the fact like a sensible man, that he ought to know something about this business of keeping cows for dairy purposes and that he ought to keep a dairy kind of a cow. The other said no to all these propositions. How true it is in this business of keeping cows, as the good book says: "The wise man forseeth the evil and hideth himself, but the foolish pass on and are punished."

I would almost guarantee to double any man's receipts from his cows in clear profits if I could get him to spend only $5 a year for sound dairy reading, providing he will take to heart what he reads and do as other men are doing, who have tried the better way and have succeeded.

When you hear a man say, as so many do say, "I have no time for reading," or "I can't afford a little money wherewith to buy the results of experience of other men," who have been more successful than he with cows, you are tempted to ask if he would be willing to pay fifty cents for a dollar greenback? The difficulty lies right there and no where else. These men with poor, unprofitable cows will not post themselves on better methods.

Many farmers read about what successful dairymen are doing with their cows, and are apt to say:

"O well, I never can do anything like that," or else they fly the track the other way, because the results do not accord with their experience, and they say it is all a falsehood.

In my experience on this dairy question, going back to 1870, I can say that I know of hundreds of men who were down to the lowest round in the ladder, who today, are among the wealthiest and most accomplished dairy farmers in the land.

I can point you to a host of them in my own state who fifteen years ago and some not more than ten, were owning herds of cows from which they did not receive more than 125 to 150 pounds of butter per cow. Everything about them, from the dairy standpoint, was in the same low condition. Today their herds average over 300 pounds per cow. Every gave 765 pounds less of milk than the Jersey cow Louise and produced forty pounds more of butter.

thing about them has a prosperous look, for they are making money and enjoying the world. What wrought all this change? Stiring up their minds to study ; that's what did it.

Take this single example of what a dairyman, Mr. H. C. Carpenter of Minnesota, has done with his herd in a few short years. Here is a record for a year which includes a part of each of the year's 1894 and 1895. The herd consists of eleven cows:

Louise, a Jersey cow, gave 7,005 lbs. milk, made 344 lbs. butter. Midget, Jersey-Guernsey, gave 6,240 lbs. milk, made 384 lbs. butter. Star, Grade Guernsey gave 5,385 lbs. milk, made 348 lbs. butter. Pansy, Grade Jersey, gave 6165 lbs., milk, made 360 lbs. butter. Cherry, Grade Jersey, gave 5,115 lbs. milk, made 339 lbs. butter. Fawny, Jersey, gave 4875 lbs. milk, made 270 lbs. butter. Pink, Jersey-Guernsey, gave 4620 lbs. milk, made 313 lbs. butter. Baby, Jersey, gave 4680 lbs. milk, made 333 lbs. butter. Flora, Shorthorn, gave 4350 lbs. milk, made 254 lbs. butter. Blackberry, Grade Jersey, gave 4750 lbs. milk, made 277 lbs. butter. Jelly, Jersey, gave 4240 lbs. milk, made 350 lbs. butter.

The foregoing is an average of 322 lbs. of butter per cow and an average of 4866 lbs. of milk.

When Mr. Carpenter was asked the question "Did you raise most of your cows?" He gave this answer, which shows that it was not a difficult matter to own such a herd:

"About eight of the cows I was fortunate enough to secure were Jerseys and Jersey grades. It was the result of a city gentleman coming out and taking a herd of Jersey cows only. He thought it would be fun looking after those Jerseys. But he *did not fulfill the laws the cows required* and the result was they did not give any milk and he got thoroughly sick of them. I heard they were for sale and went up and bought them. I do not advocate any farmer going into any lavish expenditure of money to get cows to breed from but do not be afraid to pay well for a good one. Take the dairy type and take a thoroughbred sire and you will be astonished at the result. Think of it ! Take a calf today ; two years from today that grade calf will be giving milk and in two years from that time with ten cows you will have fifteen and in two years from that time with fifteen to breed from you will have twenty-five."

Now I have given you this statement from the lips of a man who has worked up and worked out the problem of creating a profitable dairy herd. Note carefully some of the lessons his story conveys.

(1). A lesson in dairy breeding. The Guernseys and Jerseys always nick well together. They are of a harmonizing, agreeing tendency. The Jersey-Guernsey grade cow, Midget,

If you have a herd of grade Guernseys put a thoroughbred Jersey sire at the head. If you have a herd of grade Jerseys, put at the head a thoroughbred Guernsey sire. I would not advocate this cross breeding with any other two breeds.

(2). Note the fact that the first owner of the cows did not fulfill the laws required. You can see the necessity for a cow owner to bestir himself to understand these laws. How can he understand them if he will not take in the necessary knowledge. He must make himself intelligent on this cow question.

(3). That these cows yielded fully two hundred pounds more of butter each than the average cow does that the average farmer is so contented with.

To produce as much butter as these eleven cows produced would require twenty-eight cows of the average kind. Now if you want to see how the improved cow and the improved dairyman both combine to make good profit, just imagine Mr. Carpenter on one farm with eleven cows doing the same business that the average farmer would require twenty-eight to do. Think of what a nice profit there would be in the cost of keeping those extra seventeen cows.

Then think that the twenty-eight average cows do business at an absolute loss, and you can gain some idea where thousands of farmers find themselves who will not believe though an angel from Heaven came down and declared the truth to them. Even the poor unprofitable cow that is eating right into their vitals every day cannot make them see it.

Mr. Carpenter and his cows are the result of making a study of dairy wisdom. The average farmer with his average cow is the result of refusing to learn the lesson of profit and loss.

Verily the Good Book is right when it says, "The wise man forseeth the evil and hideth himself"—(behind a good cow) —"but the foolish pass on and are punished"—with poor cows).

I have cited you the case of Mr. Carpenter because I wished to show what a man could do in a comparatively new state. The same demonstration can be found in almost any state in the Union. The same principles, the same law, can be applied everywhere.

(1). The man of dairy intelligence.

(2). The cow of dairy blood and capacity.

Such a man will have such cows. One follows the other as day follows night. Such a man will study the feeding problem. He will not sneer and call it "book farming." He will study the barn and stable question. He will prosper because *he* "*fulfills* the law the cow requires."

MUTUAL RESPONSIBILITY OF THE BUTTER MAKER AND PATRON.

By Hon. W. W. Higbee of Charlotte, Vt.

Napoleon said that to particularize the bravery of his men who crossed the bridge of Lode, in the Italian campaign, he would order the roll call of the whole brigade. Call the roll of seven-eighths of the farmers of Vermont, and you will find they are dairymen.

What is the object of these meetings? What good is to result from them? If understood correctly, it is to gather the cream of individual opinions and suggestions and then try and churn out of it something of value — and this "churn test," after being properly worked, and packed, shonld show how much the associations are worth to the state.

The best creamery that money can build and equip, with ten or twenty or thirty thousand pounds of milk a day, will be a failure with a poor butter maker. Competition is so sharp, and the taste of the public has become so acute that poor butter will not sell at a profit. The maker must produce an article that the dealer takes pride in handling. The grocer does not enjoy apologizing for the off quality of his goods. The commission man who handles your output is anxious to retain your trade when he knows that the consignments are constantly kept up to a "gold standard," and he is continually asking for "more," like poor, little starving Oliver Twist, although the simile ends here, for no one will have the hardihood to say that the commission man is very often found in a starving condition.

The buttermaker should feel his responsibility. He has put into his care the entire plant. He is engineer, machinist. He should know if the machinery is working properly before a break down occurs, that proper care could have hindered, entailing vexatious delay and considerable expense. Time is money when perhaps a dozen to twenty farm teams are waiting to unload and get away to hurrying work at home.

He weighs the milk. Is he careful and correct? Are his scales kept balanced? The only answer to these two questions is Yes. I guess so, will not do. Is he getting the proper amount of cream? Is it properly ripened, so there will be the least work in churning? After the churn, the salting, packing. Is the cold storage all right? Is he careful in tak-

ing and preparing his milk samples? Is he careful and painstaking in his tests? Are his rooms clean and sweet? Are his separators free from contamination, and does he understand human nature well enough to meet his twenty-five to a hundred patrons with the wisdom of the serpent and the exceeding harmlessness of the dove, when there occurs a slight outbreak of hostilities over a difference in weights or a variation in tests? He is dealing with the pockets of his patrons, and scientists have never yet discovered in human anatomy a nerve so sensitive. Nature abhors a vacuum; so does mankind — in the pocket.

No matter how skillful your buttermaker in the details of his business, how delicate and correct his sense of taste and smell, how perfect his machinery, to make good butter he must have good milk. The fountain head must be pure, though not necessarily in a watered sense. A single can of sour milk injures an entire output for a day. A careless or obstinate or slovenly patron not only damages himself, but perhaps twenty-five to fifty others. His poor milk not only discounts the butter from that day, but it injures the reputation of the creamery, and the reputation of the maker.

No wonder the buttermaker who prides himself in his business, who calculates to make it his business, protests against the supply at times. Can he make the patron see it and understand it without a row? Perhaps so —but if he cannot, a fairly sensible kind of a rumpus is better for the creamery than a lot of poor milk.

The buttermaker must be an honest man. He must have the confidence of the patrons. There must be no partiality, no matter where the straight course hits.

This confidence will be particularly valuable to him when he reaches the vital point — as the patron looks at it—the test.

I should like to say right here in a paranthetical way, that the cash returns to a creamery patron do not depend any more upon the richness of his milk than the amount of it. Quality is all right, but quantity not infrequently brings the largest checks from the same number of cows. A dairy with a high test, where the owner makes his own butter to fill orders at high prices, will pay well, when the same number of cows with a good deal lower test and larger milk flow, will pay much better in a creamery where milk is made up together.

The buttermaker should heartily interest himself in the success of his employees. He should pride himself on the quality of his output. If the market calls for packages that require more work in preparing, he should be reasonable and helpful in the premises.

But he is not the only one who is facing responsibilities.

The patron has something to do, and a great deal to do. He should operate with the buttermaker in all reasonable ways, to any reasonable extent. If the maker tells him he cannot do good work with frozen milk, he should take pains that it does not freeze through any neglect.

If the maker tells him he cannot make first class butter from milk that has been stored in a stable or in the alley way in front of the cows, the patron should govern himself accordingly. Milk improperly strained, full of straw and hay, is not the kind of a thing the patron would place on his own table for food uses. It should be offered to no one else in that condition. If the patron has a can of sour milk, he should not expect the maker to take it. Care of milk on the farm is as important a theme for discussion as care of milk at the creamery, and it means just as much in a financial way.

Patrons should bear in mind that their cash returns depend mainly on two things; first, good milk, second, good butter making. Fine butter advertises itself. It forces its way in the market. It somehow "gets there." The best salesman in the world cannot continuously and successfully push an inferior article. The day has passed for packing fine butter in barrels, to be dug out in the rough. It is almost like stepping into an art gallery to go through the sales rooms of an up to date grocery dealer. It is the attractive package that counts to start with, though quality is all the time the essential thing. It is a business matter all around. The butter maker is paid so much for his time and skill, and the patron depends upon the nature of this work for his returns. The success of one gauges the prosperity of the other. The creamery has done a great deal for Vermont in many ways. It has raised the all around standard of her butter. It has increased her prosperity. I can name to you localities where mortgage debts have been paid largely by creamery checks, when the same land holders were before fighting a discouraging if not a losing battle. More than all the rest, it has lightened the load of care and labor that the wives in all these homes were staggering under — and when I say staggering under, the phrase is used advisedly.

Certain local "centers of trade," where Saturdays were market days and every body for miles around felt conscience smitten unless they answered to roll call, may have mild grudges laid up against the creameries, but local stores and trades have prospered thereby, to everybody's advantage. It is safe to say that the creamery is here to stay. What it does for you depends upon what you do. It will not run itself any more than a store or a bank, a locomotive without an engineer, or a steamboat without a pilot.

BANQUET.

THE SECOND ANNUAL BANQUET OF THE VERMONT DAIRYMEN'S BUTTER AND CHEESE MAKERS' ASSOCIATIONS WAS HELD IN THE BROOKS HOUSE DINING ROOM, BRATTLEBORO, VERMONT, WEDNESDAY EVENING, JANUARY 10, 1900.

The proprietors of the house did themselves credit and were equal to the emergency in every particular. Over three hundred people were seated at the tables and were filled and many baskets full left to be gathered up beside.

With Col. Hooker as toast master it was not surprising that the second annual banquet was a success.

We would gladly write an extract of each toast at this banquet but space forbids so will give only the names of the speakers, their topics and the menu.

PROGRAM.

TOASTS AND RESPONSES.

1	Invocation,	
2	The Green Mountain State,	GOV. E. C. SMITH
3	Agricultural Colleges,	PROF. J. L. HILLS Director Vermont Agricultural College and Experiment Station
4	Dairying in Canada,	H. H. DEAN, B. S. A., Guelph, Canada Professor Dairy Husbandry
5	Our Exports,	HON. H. E. ALVORD, Washington, D. C, Chief Dairy Division
6	Responsibilities of the Producer,	Hon. W. W. HIGBEE, Charlotte
7	The Agricultural Press,	PROF. G. M. WHITAKER Editor New England Farmer and Grange Homes
8	Dairy Statistics,	HON. H. W. VAIL, State Dairy Statistician
9	Sanitation,	DR. H. D. HOLTON, Treasurer American Public Health Association
10	Western Dairying,	EX-GOV HOARD, Fort Atkinson, Wis.
11	Farmers' Organizations,	HON. C. J. BELL, Master Vermont State Grange
12	The Farmer in Legislation,	HON. KITTREDGE HASKINS, Speaker Vermont House of Representatives
13	The Farmers' Needs.	HON. ALPHA MESSER. Past Lecturer of National Grange
14	Our Foreign Relations,	HON. J. L. MARTIN, United States District Attorney
15	Education,	HON. M. S. STONE, State Superintendent of Education

MENU.

"Let fellowship attend upon the meal,
And laughter aid digestion!"

Celery, Olives, Mixed Pickles, Jelly,
Vermont Roast Turkey, Cranberry Sauce,
Mashed Potatoes, Sugar Corn,
Cold Meats.
Roast Lamb, Boiled Ham,
Pressed Corned Beef, Roast Loin of Pork,
Potato Salad, Spiced Pickled Salmon,
Tea Rolls,

"The daintiest last to make the end more sweet."

Vanilla Ice Cream,
Maple Sugar Cake, White Cake,
Sponge Cake, Raisin Cake,
Nuts and Raisins, Crackers and Cheese,
Tea, Coffee.

"The feast is over, let us turn
To make the coming hour o'erflow with joy,
And pleasure crown the brim."

REPORT OF BUTTER AND CHEESE.

BUTTER EXHIBIT.

Whole number of entries,	125
Highest score,	98
Lowest score,	85
Average score.	92 4-5

Premiums awarded as follows :

CLASS 1. DAIRY TUBS.

		Prize.	Score.
1st	G. H. Terrill, Morrisville,	$10 00	96½
2d	C. H. Cobb, Westford,	6 00	96¼
3rd	T. H. Lyster, St. Johnsbury,	4 00	95½

CLASS 2. DAIRY BOX.

1st	J. B. Candon, Pittsford,	$10 00	97
2d	F. L. Davis, North Pomfret,	6 00	95
3rd	W. E. Perkins, Pomfret,	4 00	94½

CLASS 3. DAIRY PRINT.

1st	J. B. Candon, Chittendon,	$10 00	98
2d	Emeline L. Eastman, Passumpsic,	6 00	97
3rd	Fred A. Putnam, Weathersfield Center,	4 00	96¾

DAIRY SWEEPSTAKES. $5.00.

J. B. Candon, Chittenden.

CLASS 4. CREAMERY TUB.

1st	T. E. Donahue, Hinesburg,	$10 00	97½
2d	C. J. Hosford, Wells River,	6 00	97
3rd	Brattleboro Creamery Assn., Brattleboro,	4 00	96¾

CLASS 5. CREAMERY PRINT.

1st	Farmers Mutual Creamery, St. Johnsbury.	10 00	97½
2d	C. C. Lawless, Montpelier,	6 00	97
3rd	East Ryegate Creamery, E. Ryegate,	4 00	96

CREAMERY SWEEPSTAKES $5.00.

	Divided	
T. E. Donahue, Hinesburg,	2 50	97½
Farmers Mutual Creamery, St. Johnsbury,	2 50	97½

VT. DAIRYMEN'S ASSOCIATION GOLD MEDAL.

J. B. Candon, Chittenden, 98

GRAND SWEEPSTAKES. $10.00.

J. B. Candon, Chittenden, 98

BEST DISPLAYED PACKAGE.

J. R. Miller, Westminster, $3 00

WORCESTER SALT COMPANY PRIZES, $25.00 CASH.

To the winner of Sweepstakes and Association Gold Medal.

J. B. Candon, Chittenden.

WORCESTER SALT COMPANY'S PRIZES OF GOLD WATCHES.

CREAMERY BUTTER.

1st	T. E. Donahue, Hinesburg,		$25 Gold Watch.
2nd	C. J. Hosford, Wells River,	97	$15 Gold Watch.
3rd	C. C. Lawless, Montpelier,	97	$15 Gold Watch.

DAIRY BUTTER.

1st	J. B. Candon, Chittenden,	98	$25 Gold Watch.
2nd	J. B. Candon, Pittsford,	97	$15 Gold Watch.

DELAVAL SEPARATOR SPECIAL.

$10 for butter scoring the highest number of points in the dairy class, if made from cream separated by a DeLaval separator, won by J. B. Candon, Pittsford.

$15 for the butter scoring the highest number of points in the creamery class, providing the cream is separated by DeLaval separators, either power or hand machines, tie between T. E. Donahue, Hinesburg, and the Farmers' Mutual Creamery Co., St. Johnsbury.

ALDERNEY BUTTER COLOR, SPECIAL.

As follows: $15 to C. C. Lawless, Montpelier; $10 to D. G. Donahue, East Charlotte.

VERMONT FARM MACHINE COMPANY PRIZES

Of $2 on each entry of Butter scoring over 96 and under 98, made from their Separators or Cooley Creamer.

Brattleboro Creamery, Brattleboro,	96¾
John Bond, East Montpelier,	96
C. C. Lawless, Montpelier,	97
East Ryegate Creamery,	96
G. I. Wilcox, Woodstock,	96

ORIN DOUGLASS BUTTER CULTURE PRIZE.

T. E. Donahue, Hinesburg,	$5 00

WELLS RICHARDSON CO. PRIZES.

CREAMERY BUTTER.

To Butter Maker scoring highest on butter colored with Wells, Richardson Co.'s Butter Color. A solid Gold Medal.

1st	T. E. Donahue, Hinesburg,	Gold Medal,	97½
1st	Farmers' Mutual Cr'y, St. Johnsbury,	"	97½
2nd	C. J. Hosford, Wells River,	$5 00	97

DAIRY BUTTER.

1st	J.B. Candon Chittenden,	$5 00	98
2nd	J.B. Candon, Pittsford,	50	97
2nd	Emeline L. Eastman, Passumpsic,	50	97

LINCOLN LUMBER COMPANY PRIZES, $15.00.

For butter packed in our Tubs or Boxes.

1st	T. E. Donahue, Hinesburg,	$7 00	97½
2nd	W. V. Beach, Charlotte,	5 00	94½
3rd	J. F. Donahue, Lincoln,	3 00	92

By error the third prize was given to J. F. Donahue, which should have been awarded to D. W. F. Brothers, Williston, his butter scored 93. The Association duplicated the third prize to D. W. F. Brothers.

NELSON HALL & CO.'S PRIZES, $15.00

To the exhibitors scoring highest, using our Tubs or Boxes.

1st	C. J. Hosford, Wells River,	$7 00	97
2nd	M. A. Adams, Derby,	5 00	95
3rd	P. B. Swan, Montgomery,	3 00	88

NEW ENGLAND FARMER PRIZES.

Ten copies for one year to the eleven owners of butter scoring highest, not taking any premiums.

1	T. E. Donahue, Hinesburg,	97
2	M. A. Leach, Essex,	96½
3	Mrs. J. R. Miller, Ryegate,	96½
4	Stephen Hewitt, North Pomfret,	96½
5	W. G. Simpson, Washington,	96
6	G. I. Wilcox, Woodstock,	96
7	John Bond, East Montpelier,	96
8	G. M. Hayward, East Corinth,	96
9	D. G. Donahue, East Charlotte,	96
10	F. H. Bickford, Bradford,	96
11	N. H. Ricker, Ryegate,	96

THE COUNTRY GENTLEMEN PRIZES.

One copy to the owner of Package of Butter scoring highest in exhibition.

J. B. Candon, Chittenden, 98

To the owner of the best Cheese in the whole exhibition.

H. W. Rice, Westford, 98½

MIRROR AND FARMER PRIZES.

The John B. Clark Co., Publishers of Mirror and Farmer, Manchester, N. H., offers one year's subscription to every prize winner in Butter and Cheese Exhibit.

G. H. Terrill,	Morrisville
C. H. Cobb,	Westford
T. H. Lyster,	St. Johnsbury
James B. Candon,	Chittendon
F. L. Davis,	North Pomfret
W. E. Perkins,	Pomfret
J. B. Candon,	Pittsford
Emilie L. Eastman,	Passumpsic
Fred A. Putnam,	Wethersfield Centre

T. E. Donahue,	Hinesburg
C. J. Hosford,	Wells River
Brattleboro Creamery,	Brattleboro
Farmers' Mutual Creamery,	St. Johnsbury
C. C. Lawless,	Montpelier
East Ryegate Creamery,	East Ryegate
Mrs. W. A. Franklin,	Guildford
Alpha Messer,	Rochester
H. W. Rice,	Westford
Ed Bissonett,	Hinesburg
P. McDonough,	Hinesburg
T. B. Harriott,	Georgia

PRO RATA CLASS.

Fifty dollars to be divided among the samples scoring 90 points and over, not included in the foregoing list, of 51 cents each.

	SCORE
M. H. Miller, Pomfret; W. Z. Eaton, Hartford; G. K. Sprague, East Brookfield; L. H. Talcott, Williston; H. D. Thayer, West Brattleboro; W. S. Holt, Sunderland; Nelson A. Parks, South Ryegate; Cloud Harvey, North Barnet; J. H. Loveland, Norwich; Chas. Gates & Son, North Hartland; O. G. Carpenter, Cambridge; E. M. Cole, East Burke; John Evans, West Pawlet; W. P. Stone, Strafford.	90
J. M. Campbell, Morrisville; H. B. Leonard, North Pomfret; Chas. Lepage, Barre; C. D. Smead, West Brookfield; C. H. Bigelow, East Brookfield; P. W. Strong, North Pomfret; F. O. Smith, South Windham; G. W. Humphrey, East Burke; P. H. Holland, Newfane,	91
S. L. Bond, Wilmington,	91½
J. W. Thurber, Brattleboro; Sumner Sherburne, South Pomfret; E. C. Sherburne, North Pomfret; Hunter Bros., Lyndonville; J. W. Hamilton, West Brattleboro; C. C. Betterley, West Brattleboro; F. L. Kibbee, South Fairlee; J. F. Donahue, Lincoln; W. H. Watkins, East Hardwick; L. M. Cameron, Montpelier,	92
Betterley Creamery, West Brattleboro,	92½
Grant Cobb, Prosper; B. R. Smith, Passumpsic; D. W. Roberts, North Pomfret; C. A. Choate, West Barnet; Putney Creamery Association, Putney; G. W. Wallis, Waitsfield; G. A. Doe, Corinth; E. S. Bailey, Lunenburg; H. A. Noble, West Brookfield; C. A. Hastings, Springfield; Randolph Co-op. Creamery, Randolph; W. C. Norcross,	

Hortonville; H. F. Brothers, Williston; O. P. Dunn, West Windsor; E. P. Carpenter, West Waterford, 93

M. F. Donahue, Ferrisburg,; N. C. Stevens, West Glover; J. F. McLean, West Topsham; Noyesville Creamery, Walden, 93½

H. W. Walker, South Woodstock; G. F. Green, Woodstock; S. H. Warren, North Pomfret; Geo. W. Tuttle, Pittsfield; Frank Richmond, Hale; B. A. Hatt, South Ryegate; J. G. Turnbull, Barton Landing; C. E. Whitehill, Barnet, 94

J. C. Sherburne, North Pomfret; E. A. Edson, Chester; W. V. Beach, Charlotte; H. C. Bruce, Sharon; H. M. Sanborn, North Ryegate; H. W. Belden, Waitsfield; F. R. Hayward, Topsham; G. A. Kelley, Marshfield; F. L. Smith, Fletcher, 94½

S. W. Jewett, Middlebury; C. F. Stafford, Chippenhook; Mrs. H. L. Nichols, Hale; Highland Creamery, Derby; H. B. Chamberlin, Coventry Falls; E. A. Mitchell, Glover; E. V. Scott, Greensboro; G. H .Temple, Randolph Centre; Danville Creamery, Danville; J. R. Miller, Westminster; Passumpsic Creamery, Passumpsic; Geo. A. Allen, West Hartford, 95

E. E. Symmes, Ryegate; South Peacham Creamery, South Peacham; A. A. Stover, East Bethel, 95½

N. H. Ricker, Ryegate; J. R. Whitcher, South Ryegate; G. W. Hayward, East Corinth; D. G. Donahue, East Charlotte; F. H. Bickford, Bradford; W. G. Simpson, Washington; G. I. Wilcox, Woodstock; John Bond, East Montpelier, 96

Mrs. J. R. Miller, Ryegate; Stephen Hewitt, North Pomfret; M. B. Leach, Essex, 96½

CHEESE EXHIBIT.

Whole number of entries,	13
Highest score,	98½
Lowest score,	90
Average score,	94¾

CLASS A DAIRY PLAIN.

		Prize.	Score.
1st	Mrs. W. A. Franklin, Vernon,	$10 00	96
2nd	Alpha Messer, Rochester,	6 00	93

CLASS B DAIRY SAGE.

		Prize.	Score.
1st	Mrs. W. A. Franklin, Vernon,	$10 00	93

CLASS C FACTORY PLAIN.

1st	H. W. Rice, Westford,	$10 00	98½
2nd	Ed Bissonett, Hinesburg,	6 00	98
3rd	P. M. McDonough, Hinesburg,	4 00	96¾

CLASS D FACTORY SAGE.

1st	S. B. Harriott, Georgia,	$10 00	96
2nd	H. W. Rice, Westford,	6 00	95
3rd	Ed Bissonett, Hinesburg,	4 00	93

CHEESE SWEEPSTAKES, 5.00.

H. W. Rice, Westford, 98½

O. DOUGLASS, Boston.
ORIN BENT, "
W. I. WHITE, "
} Judges.

REPORT OF THE COMMITTEE ON RESOLUTIONS.

Resolved, That the Vermont State Dairymen's Association in its thirtieth annual convention assembled, most heartily endorses the propositions now before Congress to make oleomargarine and other imitations of the dairy products subject to the laws of the State or Territory into which they are transported and to change the tax on oleomargarine; and that it most heartily endorses the action of the National Dairy Union in its efforts to secure the enactment of these measures.

Resolved, That the recommendation of the Secretary of Agriculture that all dairy products offered for export from the United States be inspected and graded with a view of giving such products proper standing in foreign markets, is cordially endorsed by this Association and the favorable consideration thereof by the Congress of the United States is asked.

Resolved, That the thanks of this body are hereby tendered to the citizens of Brattleboro for their open-hearted and generous hospitality to the members and friends of this Association in attendance at this session; to Protective Grange for the use of their fine hall and for other courtesies extended; to the creamery Association; to the officers of the town of Brattleboro for the use of halls for the needs of the Association, and for furnishing delightful music for its meetings; to the hotels for kindnesses and courtesies afforded the members and friends of the Association; and to the railroads for reduced rates of fare.

Resolved, That the thanks of the Association be extended to Mr. Collahan of the Country Gentleman, for recitations rendered for the entertainment of those present at this session.

Resolved, That while the members of the Association regret the refusal of Pres. G. W. Pierce to remain longer in the chair, they desire to express full confidence in the newly elected president and other officers of this Association, pledge individually, their best efforts for its future success and usefulness.

ALPHA MESSER,
H. W. VAIL,
C. F. SMITH,
A. A. DUNKLEE, } Committee.

President.—This closes the meeting. I understand from the older members it has been one of the most profitable and enjoyable meetings of this association which has been held for many years.

NOTE.

It is expected that the next annual meeting will be held in Burlington the second week in January, 1901. H. C. Adams, Dairy and Food Commissioner of Madison, Wis., Prof. Robinson of Ottawa, Commissioner of Agriculture and Dairying, the best authority on dairy work in Canada, J. H. Brigham, Assistant Secretary of the Department of Agriculture, of Washington, D. C., V. E. Fuller of New York, Prof. J. L. Hills, Burlington, and other prominent speakers have been engaged to address this coming meeting.

F. L. DAVIS, Secretary.

REPORT OF SECRETARY AND TREASURER OF VERMONT DAIRYMEN'S ASSOCIATION,

From Dec. 1, '98 to Dec. 1, '99.

Balance on hand,	$ 60 46
Receivcd state appropriation,	1000 00
Received from membership,	75 00
Received from advertising,	174 17
Total,	$1309 63

BILLS PAID AS PER ORDERS.

Mary A. Derby,	$ 25 00
H. B. Chamberlin,	21 63
H. L. Doyle,	76 05
J. B. Lindsey,	20 00
Free Press Association,	57 75
John E. Gale,	6 78
G. W. Pierce,	27 10
Mrs. A. C. Ware,	3 95
Thomas J. Dillon,	54 53
S. C. Keith,	25 00
O. Douglass,	31 00
Orrin Bent,	31 00
E. E. Smith,	1 50
Anna Barrows,	30 00
George C. Wright,	3 50
H. W. Walker,	6 00

C. H. Waterhouse,	17 64
Burnham & Crosby,	3 30
Mrs. R. B. Galusha,	2 70
E. L. Hildreth & Co.,	144 40
W. H. Harrington,	21 50
P. W. Strong,	6 97
C. F. Smith,	9 25
E. L. Hildreth & Co.,	7 30
W. H. Farr,	75
Valley Creamery Association,	2 00
Brown & Moore,	2 90
E. L. Hildreth & Co.,	20 00
C. F. Smith,	37 25
H. B. Chamberlin,	14 20
F. L. Davis,	20 61
E. L. Hildreth & Co.,	50 00
J. L. Hills,	5 61
F. L. Davis,	192 40
Paid other bills, premiums, etc.,	245 79
Total expenditures,	$1225 36
Balance in treasury, $84 27	

P. W. Strong, Treasurer.

F. L. Davis, Secretary.

STATEMENT OF METHOD EMPLOYED BY WINNERS OF BUTTER PRIZES. CLASS 1, DAIRY TUB.

No.		FIRST PREMIUM. G. H. TERRILL, Morrisville.	SECOND PREMIUM. C. H. Cobb, Westford.	THIRD PREMIUM. T. H. Lyster, St. Johnsbury.
1	What number and breed of cows from which this butter was made?	23 registered Jerseys.	15 Jerseys and grades.	17 grade Jerseys.
2	How much and what kinds of feed were used per cow?	Ensilage 40 lbs., hay 8 lbs. mixed feed 5 lbs.	4 qts. corn, oats, cottonseed and bran mixed. Corn stover and oat hay.	3 lbs. bran, 4 1-2 lbs. corn meal, 1 1-4 lbs. cottonseed meal. Early cut hay, about 15 pounds.
3	What was the cost of this ration per day per cow?	12 cents.		15 cents.
4	By what process or apparatus was the cream obtained?	DeLaval Separator.	DeLaval Separator, No. 3	DeLaval Separator.
5	How long was the cream kept and in what condition when put into the churn?	3 days, sour.	3 days, slightly sour.	14 hours, slightly acid.
6	At what temperature was cream? Kind of churn used?	66 degrees, barrel.	61 degrees, box.	62 degrees, barrel.
7	What length of time churning?	30 minutes.	20 minutes.	35 minutes.
8	Do you wash and salt it while in granular form?	Yes.	Yes.	Washed in granular form but not salted.
9	What kind of salt and how much to the pound?	Worcester, 1 oz.	Worcester ¾ oz.	Worcester, ½ oz.
10	What kind of butter color used?	Wells Richardson.	Wells Richardson.	Wells Richardson.
11	What kind of worker used?	Waters.	Eureka.	Waters.
12	How many pounds of milk required to make one pound of butter? One or more workings?	16 lbs. 1 working.	19 lbs. One working.	About 21 pounds, One working.

STATEMENT OF METHODS EMPLOYED BY WINNERS OF BUTTER PRIZES. CLASS 2. DAIRY BOX.

No.		FIRST PREMIUM. John B Candon, Pittsford.	SECOND PREMIUM. F. L. Davis, North Pomfret.	THIRD PREMIUM. W. E. Perkins, Pomfret.
1	What number and breed of cows from which this butter was made?	23 native and grade Jerseys.	20 grades and full blood Jerseys.	4 Jerseys.
2	How much and what kinds of feed were used per cow?	Hay 10 lbs., silage 25 lbs., bran 3 to 4 pounds, Chicago gluten 1 lb.	Full corn ensilage, 35 lbs. cut hay mixed with ensilage, 5 lbs. meal and mixed feed (mixed 1 of meal to 2 of bran), 1-3 lb cotton seed.	15 lbs. hay, 6 lbs. corn meal, 3 lbs. mixed feed.
3	What is the cost of this ration per day per cow?	13 cents.	Nearly 13 cents.	16 cents.
4	By what process or apparatus was the cream obtained?	DeLaval No. 3.	DeLaval Separator No. 3.	DeLaval Separator.
5	How long was the cream kept and in what condition when put into the churn?	Two days, thick, slightly acid.	3 days, acid.	1 to 3 days, sour.
6	At what temperature was the cream? Kind of churn used?	61 degrees, Stoddard barrel.	62 degrees, Davis swing.	60 degrees, Square.
7	What length of time churning?	40 minutes.	1 hour.	15 minutes.
8	Do you wash and salt it while in granular form?	Yes.	Washed in granular form, salt in worker.	No.
9	What kind of salt and how much per pound?	Worcester ¾ oz.	Worcester ¾ oz.	Worcester, ¾ oz.
10	What kind of butter color used?	Wells Richardson.	Wells Richardson.	Wells Richardson.
11	What kind of worker used?	Waters.,	Waters.	Circular table.
12	How many pounds or milk required to make one pound of butter?	19½ lbs.	17 lbs.	15 lbs.
	One or more workings?	One.	One.	One.

STATEMENT OF METHOD EMPLOYED BY WINNERS OF BUTTER PRIZES, CLASS 3, DAIRY PRINTS.

No.		FIRST PREMIUM J. B. CANDON, Chittenden	SECOND PREMIUM EMILIE EASTMAN, Passumpsic.	THIRD PREMIUM FRED A. PUTNAM, Weathersfield Center.
1	What number and breed of cows from which this butter was made?	8 natives.	35 high grade Jersey cows and heifers.	7 grade Jerseys.
2	How much and what kinds of feed were used per cow?	Hay 11 lbs., silage 40 lbs., bran 2 lbs.	Hay 10 lbs. ensilage 30 lbs., grain 10 lbs. mixture, (bran 500, gluten 200, cottonseed 100).	3 qts. cut carrots, 2 qts. ground corn and oats, pint cream gluten, hay twice, dry corn fodder.
3	What is the cost of this ration per day?	14 cents.	14 cents.	10 cents.
4	By what process or apparatus was the cream obtained?	DeLaval Separator.	DeLaval Separator.	Sharples Separator.
5	How long was the cream kept and in what condition when put into the churn?	7 milkings sour.	3 days, kept sweet till 24 hours before churning then ripened.	2 days, slightly acid.
6	At what temperature was the cream? What kind of churn used?	62 degrees, Stoddard churn.	61 degrees, barrel.	64 degrees, Davis swing.
7	What length of time churning?	45 minutes.	65 minutes.	40 minutes.
8	Do you wash and salt it while in granular form?	Yes.	Yes.	Yes.
9	What kind of salt and how much per pound?	Worcester, ½ oz.	Genesee ¼ to ⅝ oz.	Worcester, ¾ oz.
10	What kind of butter color used?	Wells Richardson.	Wells Richardson.	Thatcher.
11	What kind of worker used?	Waters.	National.	Reids.
12	How many pounds of milk required to make one pound of butter? One or more workings?	20 lbs. One.	16 lbs. Two.	20 lbs. Two.

STATEMENT OF METHOD EMPLOYED BY WINNERS OF BUTTER PRIZES. CLASS 4 CREAMERY TUB.

No.		FIRST PREMIUM T. E. DONAHUE, Hinesburg	SECOND PREMIUM. C. J. Hosford, Wells River.	THIRD PREMIUM. Brattleboro Creamery Association, Brattleboro
1	What number and breed of cows from which this butter was made?	Mixed breed.	Mixed and grade Jerseys.	Mixed breed.
2	How much and what kinds of feed were used per cow.			
3	What is the cost of this ration per day?			
4	By what process or apparatus was the cream obtained?	DeLaval Separator.	DeLaval Separator.	Cooley.
5	How long was the cream kept, and in what condition when put into the churn?	24 hours, slightly acid.	18 hours, ripened.	18 hours, acid.
6	At what temperature was the cream? Kind of churn used?	58 degrees, box.	58 degrees, box.	68 degrees, Square box.
7	What length of time churning?	40 minutes.	35 minutes.	50 minutes.
8	Do you wash and salt it while in granular form?	Yes.	Yes.	Yes.
9	What kind of salt and how much used?	Worcester, ¾ oz.	Worcester ¾ oz.	Worcester, ¾ oz.
10	What kind of butter color used?	Wells Richardson.	Wells Richardson.	Wells Richardson.
11	What kind of worker used?	National.	National.	Vt. F. M. Co., power.
12	How many pounds of milk required to make one pound of butter?	19 lbs.	18½ lbs.	
	One or more workings?	One.	Two.	One.

STATEMENT OF METHOD EMPLOYED BY WINNERS OF BUTTER PRIZES.—CLASS 5, CREAMERY PRINT.

No.		FIRST PREMIUM. Farmers Mutual Creamery Co., St. Johnsbury.	SECOND PREMIUM C. C. Lawless, Shady Rill Creamery, Montpelier.	THIRD PREMIUM East Ryegate Creamery, East Ryegate.
1	What number and breed of cows from which this butter was made?	2500 cows, Jerseys and Grades	About 200 grade Jerseys.	15 grade Jerseys.
2	How much and what kinds of feed were used per cow?			
3	What is the cost of this ration per day?			
4	By what process or apparatus was the cream obtained?	Cold water setting and centrifugal separator.	U. S. Separator.	U. S. Separator.
5	How long was the cream kept and in what condition when put in the churn?	48 hours; slightly acid.	About 20 hours. 5 per cent. acidity.	One day.
6	At what temperature was the cream? Kind of churn used?	56 degrees; box.	55 degrees; Vt. F. M. Co., box.	55 degrees, U. S.
7	What length of time churning?	30 minutes.	63 minutes.	65 minutes.
8	Do you wash and salt it when in granular form?	Yes.	Yes.	Yes.
9	What kind of salt and how much to the pound?	Genesee, ¾ oz.	Worcester, ¾ oz.	Worcester, 1 oz.
10	What kind of butter color used?	Wells Richardson.	Alderney.	
11	What kind of worker used?	National.	Mason.	National.
12	How many pounds of milk required to make one pound of butter? One or more workings?	20¼ lbs. One.	18 ½ lbs. One.	

STATEMENT OF METHOD EMPLOYED BY WINNERS OF CHEESE PRIZES. BLASS A. DAIRY PLAIN.

No.		FIRST PREMIUM. Mrs. W. A. Franklin. Guilford.	SECOND PREMIUM. Alpha Messer, Rochester.	
1	What number and breed of cows from which this cheese was made?	8 grade Jerseys.	6 grade Devons.	
2	What was their feed?	Pasture and C. S. meal.	Pasture.	
3	Was the milk aerated and by what process?	No.	No.	
4	What was the age and temperature of the milk when the rennet was applied?	None over 12 hours. 98 degrees.	12 hours and fresh. 82 degrees.	
5	What preparation of rennet did you use and how much per thousand pounds of milk?	Calves rennet.	Factory.	
6	Describe your method of procedure through the remainder of the process of making?	Great care in handling, no haste, and strict attention to every detail.	Farm kitchen method.	
7	How long ago was this cheese made?	In August.	Last of August.	
8	How many pounds of milk did you require to make one pound of cheese?	Don't know as I never weighed any.	About nine.	
9	What was the average net price received for your cheese per pound last season from May 1 to November 1?	Sixteen cents and over.		

STATEMENT OF METHOD EMPLOYED BY WINNERS OF CHEESE PRIZES. CLASS B. DAIRY SAGE.

No.		FIRST PREMIUM. Mrs. W. A. Franklin, Guilford.		
1	What number and breed of cows from which this cheese was made?	8 grade Jerseys.		
2	What was their feed?	Pasture and C. S. meal.		
3	Was the milk aerated and by what means?	No.		
4	What was the age and temperature of the milk when the rennet was applied?	None over 12 hours. 98 degrees.		
5	What preparation of rennet and how much per thousand pounds of milk?	Calves rennet.		
6	Describe your method of procedure through the remainder of the process of making?	Great care in handling, no haste, and strict attention to every detail.		
7	How long ago was this cheese made.	In August.		
8	How many pounds of milk did you require to make one pound of cheese?	Can't tell never weighed it.		
9	What was the average net price received for your cheese per pound last season from May 1 to November 1?	Sixteen cents and over.		

STATEMENTS OF METHOD EMPLOYED BY WINNERS OF CHEESE PRIZES.—CLASS C. FACTORY PLAN.

No.		FIRST PREMIUM. H. W. RICE, WESTFORD.	SECOND PREMIUM. EDD BISONETT, HINESBURG.	THIRD PREMIUM. P. MCDONOUGH, HINESBURGH.
1	What number and breed of cows from which this cheese was made?	Four hundred mixed breeds.	Three hundred mixed breed.	Six hundred mixed breed.
2	What was their feed?	Grass and cornfodder.	Grass and cornfodder.	Grass and cornfodder.
3	Was the milk aerated and by what means?	By stirring.	By dipping.	By dipping.
4	What was the age and temperature of milk when the rennet was applied?	Nights and mornings temerature 8o.	Nights and mornings; temperature 83.	Nights and mornings; temperature 85.
5	What preparation of rennet did you use and how much per thousand pounds of milk?	Jones rennet extract, four oz. to thousand pounds of milk.	Jones extract, 4 oz.	Home preparation.
6	Describe your method of procedure through the remainder of the process of making?	Salted with Genesee salt four pounds to thousand pound curd, tried with hot iron.		Heat to 100 degrees, use hot iron test.
7	How long ago was this cheese made?	In September.	4 months.	2½ months.
8	How many pounds of milk did you require to make one pound of cheese?	About 9 pounds.	9 pounds.	8¾ pounds.
9	What was the average price paid your patrons per pound of cheese last season from May 1 to November 1?	About 10 cents.	11 cents.	90 cents per hundred for milk.

STATEMENT OF METHOD EMPLOYED BY WINNERS OF CHEESE PRIZES. CLASS D. FACTORY SAGE.

No.		FIRST PREMIUM. T. B. Harriott, Georgia.	SECOND PREMIUM. H. W. Rice, Westford.	THIRD PREMIUM. Edd Bissonett, Hinesburg.
1	What number and breed of cows from which this cheese was made?	400.	200 all breeds.	300 grades and Jerseys.
2	What was their feed?	Pasture.	Grass and corn fodder.	Grass and cornfodder.
3	Was the milk aerated and by what means?	No.	By stirring.	By dipping.
4	What was the age and temperature of milk when the rennet was applied?	Nights with 12 hours mornings with fresh.	Nights and mornings. 80 degrees.	Nights and mornings.
5	What preparation of rennet did you use and how much per thousand pounds of milk?	Hanson's extract. 2½ oz. per 1000 of milk.	Jones extract. 4 oz. per 1000 of milk.	Jones extract. 4 oz.
6	Describe your method of procedure through the remainder of the process of making?	Heat to 98 degrees. Draw whey first shows acid. Cut in blocks. Grind when acid 1 3-4 in Salt 2 1.2 lbs. to 1000.	Salted with Genesee salt. 4 lbs. to 1000 pounds milk. Tried with hot iron.	Heat to 98 degrees, remain in whey about 3 days, dry sage added.
7	How long ago was this cheese made?	September 10.	September.	3 months.
8	How many pounds of milk did you require to make one pound of cheese?	8½ pounds.	About 9 pounds.	9 pounds.
9	What was the average price paid your patrons per pound of cheese last season from May 1 to November 1?	Don't know.	About 10 cents.	11 cents.

WOMAN'S AUXILIARY.

A special meeting of the Woman's Auxiliary was held in the Brooks House parlors Wednesday, January 10, at 1.30 p. m.

Ex-Gov Hoard of Wisconsin spoke for a few minutes upon the value of women as an aid to successful business enterprises, especially those connected with the farm and home life and urged strongly the proper education of the girls and boys.

PRESIDENT'S ADDRESS.

Mrs. Mary A. Smith, Morrisville.

We are privileged to meet again as the Woman's Auxiliary to the Vermont Dairymen's Association. We are glad to renew the acquaintance of so many of our members and it also gives us pleasure to see so many whom we have not met before.

Perhaps you are not all familiar with the object of the Woman's Auxiliary. To such we say, it is to do the Vermont women good by keeping them in touch with the best methods in domestic science, learning from each other, and from those whose aid we are fortunate in obtaining, helpful, profitable ways of making the farmer's home what it should be, the center of prosperity and happiness.

With the advent of the creameries, and the ways of caring for the product of the dairy by means of machinery, the farmer's wife is relieved of much care and work that a few years ago fell to her lot. But this should not lessen her interest in the meetings of the State Dairymen's Association, for if we have good dairying and good farming we should also have good home making. And how can this be unless our women grasp every opportunity for improvement and inspiration. There is no greater need for all classes today than a developing of the highest conception of the family home ; and does not the farm home possess ability to come nearer the ideal than any other?

It is true that within our remembrance agriculture had lost its dignity and prestige, and the farmer himself habitually placed a very low estimate upon his own and his neighbor's worth. But we are glad that a change has come and today a tiller of the soil may, if he will, take his rightful place among men without fear of ridicule or censure. There is no

neutral ground and the farmer and his family must keep pace with the progress of the rest of the world, or lose influence and position.

There is much talk and theorizing about woman's rights and duties, but she can and certainly should teach the children that work, even hard work, to provide or prepare food and clothing for the family is neither dishonorable or unrefined. The child is to be pitied whose mother does not feel the need of providing regular work for the different members of the family. A reasonable task at fixed times soon forms a habit and makes it much easier to assume the greater cares that always come to the ambitious child.

Prof. Wm. James of Harvard, in his text book on psychology says, "Could the young but realize how soon they will become mere bundles of habits they would give more heed to their conduct while in the plastic state." While there is much truth in this, is not the mother more responsible than the child? Is it not one of our rights to instruct the children concerning harmful effects of narcotics and alcohol on the human system, using every effort to induce the boys and girls to form temperate habits early in life?

Mrs. Ida H. Read, State President of the Woman's Christian Temperance Union, in her annual address before the convention at Barre last September said, "that the greatest obstacle she found in temperance work in our State was the apathy of our christian women."

It is amazing that women can continue indifferent when our boys of the late Spanish-American war came home to tell of the destruction and ruin wrought among them by the army canteen, and when we remember that those high in authority have placed an interpretation upon the law prohibiting the army canteen in the interest of the liquor traffic.

The women of our state can find work with petitions and resolutions at our next legislative session and they need not petition for the ballot either.

The prevalence of cigarette smoking should arouse every mother to action, and there are among us social problems that should be soon solved by clear intelligent minds.

We should seek to inform ourselves along the lines of correct sanitation and ventilation, not ceasing our investigation until we know just how, and what food is necessary to make good blood, for "the blood is life."

The education of our girls should be an all engrossing subject. Those who have thought much on the subject believe that farm life demands on the part of women as well as men a special culture and training more largely scientific and practical than that given in the high schools now. More time

should be given to botany, chemistry, entomology and all those branches that help one to adminster in a scientific manner to the comfort and well being of a family.

It is conceded that dyspepsia is caused largely by improper food. How important then that we hasten to correct our methods in cooking, for we have been called "a nation of dyspeptics." This claim perhaps may be unjust, but who can say that the cause of much of the intemperance, vicious morals, and domestic estrangements may not be easily traced to foods ill adapted to the natural needs.

If we teach our girls to be good cooks then we have done our part, and started them on the right road to be good home builders; and our homes are the hope of the nation.

It should be our aim to raise the honor and establish the dignity of the duties of the family state, and to make all work in the farm home as much desired and as respected as are the most honored professions. To do this women must appreciate the importance of their work, and lose no opportunity for improvement. For this purpose this auxiliary to the State Dairymen's Association was formed, and few have pledged themelves to work for its success, feeling sure that much good will come of it.

Mrs. Janet M. Hill, Hyde Park, Mass., editor of The Boston Cooking School Magazine, gave an informal talk upon What to eat and how to cook it.

She said that the proper cooking of an egg and a potato comprised the correct principle of all cooking. If eggs are cooked slowly they will be jelly like and easily digested ; if cooked at a high temperature they will be hard and indigestible. This applies to meat cooking or to any thing that contains albumen. A tired person should drink slowly a cup of simple soup, a hearty dinner may then be eaten a half hour later. Soups should not boil but should simmer only; add the vegetables and seasoning only long enough before the end to extract the flavor. If you wish to boil meat, plunge it into boiling water; then move it to the back of the range. Starch foods require a different treatment and perfect cookery. If cooked at a high temperature starch will be converted in part into sugar. Sauces should be made by heating butter until it bubbles, flour is then to be added and milk or water poured on. Warmed over meat is hard to digest and should not be used. Smaller quantities used fresh are preferable. The higher priced meats are not the most nutritious. Mutton is the best meat to use for older people. The pink skin should be removed as that has rank taste. Cook at a low temperature. Meat once a day is generally sufficient. Fish is a valuable

food especially for brain workers and should be prepared in an attractive manner which appeals to the eye.

Cheese should be combined with food that can be cooked at a low temperature. Meat contains all the necessary elements of food. Marcaroni should be used more freely. Throw into boiling water, cook until tender, then combined with cheese, milk or bread, with a small quantity of soda added. Bread should be made in small loaves thoroughly cooked to destroy the yeast germs.

Children should be taught to chew their food well and to eat the crusts; give them cream or buttter with their bread.

Men and women are beginning to realize that hygienic cookery is one of the most important questions of the day and are studying to find what is the best food for family use. Questions in regard to eggs and their use brought out a palatable dish as follows: Two eggs, yolks and whites beaten separately, two table spoonsful of water added to yolks, whites folded in, salt and pepper, set in oven to cook, pour over one-fourth cup of white sauce and one cup of peas.

Mrs. Sarah J. R. Whitman Brattleboro, read a paper upon Housekeeping as a Profession. She said skill was absolutely necessary for the household and that the kitchen work should be exalted to its proper position. Girls especially should receive careful training for this purpose.

Mrs. Jennie Bronson of Hardwick read a paper upon Our Boys and Girls. She said that parents should realize that heart culture was just as necessary as head culture, therefore moral teachers are a necessity. The parents should be friends of the teacher and their own children. The training given by society should be carefully considered before the child leaves home very much.

The following were elected for officers:

President, Mrs. Mary A. Clark, Williston.

Vice-President, Mrs. Bessie H. Strong, North Pomfret.

Secretary, Mrs. Alvira A. C. Ware, Brattleboro.

A vote of thanks was extended to Mrs. Mary A. Smith for her efforts during the years she had been connected with the auxiliary as an officer. It was voted to adjourn to meet again at the same time and place of the Vermont Dairyman's Association.

Tuesday Evening.

President Pierce. Ladies and Gentlemen, I have the pleasure of presenting to you, this evening, Mrs. Mary A. Smith of Morrisville, President of the Woman's Auxiliary of the Vermont Dairyman's Association.

Mrs. Smith. Mr. President, Ladies and Gentleman.— It is with pleasure to greet you tonight and in behalf of the Woman's Auxiliary of the Vermont Dairyman's Association, I bid you welcome.

Standing, as we do tonight, in the twilight of the century we can scarce refrain from meditating upon the changes that have come to us in these last few years that go to make up the era of time that is called the nineteenth century.

We are none of us old. The frosts of time may have touched our hair, our hearing may be a little dull, our step less elastic, but associations we have formed in these valleys and on these hillsides have attuned our hearts to the melody, "we are still young." But young though we are, most of us can remember when there were no gatherings like the present for improvement and education. Most of us can remember when the sphere of woman was bounded by the four walls of her home. Most of us can remember when the church with its mid-week prayer meeting and here and there an Odd Fellows' lodge or Free Masons' lodge constituted about all the societies there were. Now any one of our churches with organized detachments will furnish a meeting for every evening of the week.

All kinds of labor are organized into sections and look after their own interests ; and those of us who are not permitted to take part in the matter, have thought a great many times that our political system, free and simple though it may seem, was run on a sort of organized plan, a sort of Ferris wheel, that dropped off a man just at the right time without any regard for the consequences. To just what extent our efforts should be organized is a debatable question. Certain it is that Dairymen's Associations have done a good work in this and other states ; and the Woman's Auxiliary is endeavoring to further this work by bringing to your attention from time to time subjects that are of interest, not only to the dairywoman but to the dairyman and his family and to the stranger within his gates.

Some people claim that the civil war was responsible for the discovery by women of the great possibilities for her intel-

ligent advancement; while others affirm that the position woman occupies today is the natural result of evolution. Be this as it may the fact remains that woman today, woman in these last decades, has become more intelligent, broader minded and has widened her sphere of usefulness.

We are privileged to have with us tonight one who has identified herself with one of the cooking schools that we hear of in our cities, one who has looked into the matter of food and its preparation and she will no doubt be able to tell us not only of the most economical foods for us to use, but also tell us how we can prepare those foods with the least expenditure of time.

It gives me pleasure to introduce Mrs. Janet M. Hill, of Hyde Park, Mass., editor of The Boston Cooking School Magazine.

Mrs. Hill in her address referred to the care exercised in keeping the battleship Oregon in perfect condition while on its way from California around the stormy cape and up to the seat of war.

She was fashioned for speed and every part of her machinery was kept polished like glass, the coal selected with care and skill and everything kept in readiness to do its best work if needed.

Should not equal care be given to the wonderful machinery of the human body? Horses are fed for speed, for grace or for strength. Pugilists and ball-players are obliged to give strict attention to diet and drink. The cow is fed for the special object in view. It is conceded that live stock is fed more scientifically than are human beings. Dr. Hay says that it ought to be possible to formulate a dietary, as accurate in substances and combinations as a medical formula.

There are truths concerning food which should be understood by everyone. The proper cooking of albumen in eggs, milk, cheese and meat is the foundation of all hygenic cookery. They should be cooked at a low temperature; potatoes should boil furiously; while a leg of mutton, a fowl or soup should but just bubble.

Knowledge not wealth will enable one to prepare food which transformed will reappear in such thoughts and emotions as we find in poems of Homer, Milton and Shakespeare, in the music of Mozart and Mendelssohn and in the painting of Raphael. We eat to supply material for the repair and building up of our bodily tissues, and to secure the requisite amount for muscular and mental energy needed to perform the countless activities of life and to generate heat. We attain these several ends by a proper and scientific selection of food. All food contains one or more of the five food principles, pro-

tein, fat, carbon hydrates, mineral salts and water. Protein (proteids) is the muscle builder or flesh former, carbohydrates and fats are force producers or work food, and also heat foods, the mineral salts support the bony structure while water which is found in all foods is a common carrier of nutrition and waste material, and by its evaporation on the surface it regulates the temperature of the body. Three pints is none too much water on the average to introduce into the system either in combination with other principles or in a liquid state. Mineral salts are known to us as chloride of sodium, common salt, lime, iron, magnesia, etc., and are found in nearly all foods but in greater proportions in milk, meat and vegetables. Their office is largely to build up and repair bone. Butter, oil and cream and the fat of meat represent the fat which when oxidized supply heat. Carbohydrates are known to us principally as starch and sugar. Protein is represented in the animal kingdom, eggs, milk, cheese, meat, and in the gluten of grains, also peas, beans, etc. The proportions of these principles depend upon how much we wish to grow or exercise or how much heat we must supply. This is the gist of the whole matter and we must work out our own salvation and that of our family. We should be able to supply what the ever varying needs of the system demands and withhold whatever clogs or taxes it too heavily.

The average growing child needs four parts carbohydrates and fat to one of protein, adults need five and one-half parts carbohydrates and fat to one of protein. If sickness occurs a different diet is needed. The Japanese government suggests that its people try eating more flesh as a means of increasing their stature. What we need is stronger bodies. Good food must be properly cooked or the desired result will not be gained. She who prepares the main-spring of the activities of the family should understand the rudiments of that art. It is simple, well-cooked food, daintily served, masticated with energy, but eaten slowly that builds up the system. Every person should possess an elementary knowledge of physiology and of the combinations of food.

Where can the subject be better taught than in the public schools. Each boy and girl upon leaving school should have a thorough knowledge of this subject. We need a more competent and wide-spread knowledge of the different values of food products, their appropriate and seasonable combinations for hygenic use and their effect upon different temperaments.

QUESTIONS.

What are the most healthful foods for breakfast for a cold morning?

Mrs. Hill.—Each member of the family needs to be taken into consideration. People as a rule eat about the same thing. Women who remain in the house should not eat a hearty meal; a man needs more fat and the woman less. Bacon and eggs make a good breakfast for cold mornings. Children should eat eggs. A cereal, if cooked long enough, is not objectionable. It should be eaten without sugar and not too much milk used or it will not be chewed enough. A physician in the West states that nearly every one is ailing, that too much starch is eaten in fried potatoes, cereals, etc., and too much coffee drank. A child should not be allowed to drink coffee.

Question.— If a man is cross what sort of a ration would you advise for him?

Mrs. Hill.— Crossness is generally caused by the food one eats. Do not give any fried food, but light food like soup or boiled eggs.

Question.— Is soup nutritious?

Mrs. Hill.— It depends upon the kind, when made from bones, it is not. A cream soup made with vegetables is nutritious. A light soup stimulates. People do not eat enough soup.

Question.— How should coffee be made?

Mrs. Hill.— A clean coffee pot, not a tin one; coffee ground as you like it, mixed with the shell and white of an egg and a small quantity of cold water. Pour on the hot water and boil from three to five minutes, set it back for ten minutes and serve. It is more wholesome without milk or sugar, but it is not as nutritious.

Question.— What kind of tea is most healthy and how should it be made?

Mrs. Hill.—Not the green or any colored tea. The teapot should be clean and hot, pour fresh boiling water over the tea and let stand five minutes.

Question.— What is good for dyspepsia?

Mrs. Hill.— There are several different dyspepsias, nearly all of which are caused by food. Dyspeptics should not eat pastry or sweets. Toast and tea can generally be eaten and sometimes eggs.

Question.— What is the proper proportion of protein and carbohydrates for human eating?

Mrs. Hill.— About one part protein to four parts carbohydrates. A large person needs more than a small one. The heartiest meal should be eaten after the hard work is done, if you can sit down and converse, thus giving it a better chance to digest. People should not go to bed directly after eating as food does not digest as well while sleeping.

Question.— What of white bread as an article of diet?

Mrs. Hill.— When there is a large variety of food to select from it is well enough. The gluten in the dark bread corresponds to the protein in meat. Whole wheat bread can be made just as you make the white bread and is more healthful.

Question.— Is the habitual use of tea and coffee hurtful?

Mrs. Hill.— Large amounts are detrimental, taken occasionally they are a mild stimulant.

HOME LIFE ON THE FARM.

Hon. Mason S. Stone.

Mr. President, Ladies and Gentlemen:

There has been a great contention between the old school of philosophy and the new school. The old school maintained that all vulgar fractions should be reduced to a common denominator; the new school claims that each fraction should remain in its simplest form, for in this manner it best fits into the universality and fulfills the purpose of life. The old sought for uniformity; the new seeks for individuality; one looked at the denominator, the other considers the numerator as well.

If the idea of the old school should obtain this world would be dull and uninteresting, for there would be no individuality, no peculiarity, no idiosyncrasy, no characteristic. And just think how tame and tasteless life would be if all women smirked alike and smiled alike, talked alike and walked alike, dressed alike and looked alike, acted alike and scolded alike. The very charm of earthly bliss would vanish and disappear, and life itself would be a weary waste of dreary years.

I have always had deep sympathy for that specie of bird known as the mourning dove. It belongs to the only family of bird that mates for life, and as each Mrs. Dove is so near a duplicate of every other Mrs. Dovey Dove, it is only natural that there should be some sensational mistakes, and much domestic infelicity. Perhaps that is the reason they are called "Mourning Doves."

But the new school of philosophy has given us a wise interpretation of life and preaches a more rational gospel. It claims an equality in the distribution of gifts, the possession of the common virtues by all, a discoverable good in each; but it also recognizes a diversity, a difference in kind and degree of gifts, and believes that equality in this life consists in the highest development of talents given. The difference in men is one of opportunity and training rather than of talent.

It is by individuality that we recognize, know and like people. A feature of the face, a twinkle of the eye, a motion of the hand, a pose of the body, an inflection of speech, a quality of voice, a cadence of step, are the little labels by which we recognize people. Nature exhibits the same individuality,—no two trees, no two blossoms, no two kernels of corn, no two grains of sand, no two feathers of a bird, no two animals, and no two persons are exactly alike.

It is individuality that gives the spice and sparkle to personality, that conveys the subtle, unuttered, but potent power we call influence. We like people who are individual — who do not say what everybody else says, who do not do things because polite society says it is the proper thing, who do not dress minutely in fashion, who do not serviley conform to the dictates of the impersonal "they," but who are individual, independent, and hence influential.

And just as we like people who are individual, so do we like homes that are individual. In this respect the country home has a great advantage over the city home. In a manufacturing town or city the homes for the operatives are either in a block, whose sequence of doors and windows is painful, and each particular home denoted by a number only, or the homes are in separate houses which are situated the same distance from the street, are of the same dimension, have the same arrangements, chimneys, doors and windows, and all are painted alike — hence in either case no individuality. They are simply abiding places not homes.

The house of the proprietor may be located in some principal street, may cost as much as the appraised valuation of several towns in Vermont, may exhibit in architecture the art of a Wren or in construction the ability of a Stevenson, but is so hedged and hemmed in that it cannot express its beauty or individuality.

Along Columbus Avenue in Boston, or Fifth Avenue in New York, or Wabash Avenue in Chicago, there is but little external home expression. It is this home individuality that makes home so dear, that nurtures fond memory, that creates an ever abiding image, that makes the heart of the home-coming one thrill with love and emotion. But that around which our warmest sentiments gather ; that toward which tends the heart's most ardent feelings; that which is the dearest spot on earth, is the old home fireside. Yet that which makes this so dear a spot, that which casts a sacred halo about the place, that which awakens the fondest recollections and tenderest affections, is mother. From early chlidhood to life's closing days, there is no other name so dear, no other face so sweet, no other voice so gentle, no other life so pre-

cious. Not only is she the soul and center of every home, but she is the great world's moral force. In all ages and in all countries, this quiet, patient, self-sacrificing woman has done more for humanity and the world's regeneration, than legislators and statesmen, than poets and preachers. than scholars and philanthropists. As the mother is so is the home. Whether in the country or city, each has her advantages and disadvantages, each has her dangers and safe-guards, each has her joys and sorrows ; one is drawn away by society, the other is hemmed in at home ; one is neglectful of maternal care, the other hardened by isolation ; one is troubled over social standing, the other is sad from social lack. But each daily sheds an unfailing fragrance of home influence and the benediction of a mother's prayers.

As the mother makes the home whether in city or country, it is difficult to study the home without treating of the mother. But as it is our purpose to speak externally of home influences, we shall leave the mother and fireside to your own memories and imaginations.

It is passing into proverb that the country boy enjoys the advantages of his disadvantages, while the city boy suffers under the disadvantages of his advantages.

All the opportunities for culture in art and science, in history, ethics and humanity, are free to the youth of the city ; lectures, libraries and art galleries are open ; historic places, marvels in architecture, the magic wonders of science, marts of trade and traffic are at hand; all that man has done is within reach and can be seen. And so the city boy is in constant contact with evidences of human nature, while the country boy comes in touch with the evidences of external nature ; one daily beholds the works of man while the other daily beholds the works of nature.

Because the denizens of a city are surrounded and under the influence of man's work, it is only natural that pessimism and cynicism should flourish luxuriantly in the city; but to those who dwell under the influence and amidst the opulence of nature, she gives her songs, her fragrance and her beauty, — one is naturalized by living with nature, the other becomes artificial by living with human nature. One becomes joyous in his sense of rustic freedom and the beauty of life, the other becomes reserved through his limitations of city environment. One puts on the true habiliments of heart in field and wood, the other puts on the habiliments of the drawing room through associations with so-called polite society. One may become quaint, awkward and unconventional in the country, but he does not become dudish, blase or supercilious.

The impressions of nature are simple and early, those of hu-

man nature, complex and late; the worship of nature is primitive, the admiration of human nature is advanced ; man as a creature loves and worships nature, as a rational being, he recognizes human nature as God-inspired and God-illumined, and so makes self-sacrifice for the benefit of the race.

Nature is elementary, human nature is higher ; nature is the primary school, human nature the academy ; nature is for youth, human nature for manhood.

The relative characteristic of country and city may be stated as follows:

Man was born in the country ; humanity in the city. The home was organized in the country ; society in the city. Religion is originated in the country ; christianity in the city.

It is customary for people to say that "God made the country and man made the city." This is only a three-fourths truth. The whole truth is,— God made the country, and He and His children built the city. Yet with all the advantages accruing to a child from the higher and human side of the city life, he lacks the earlier, fundamental and essential advantages of country life. In the city nature is not free and rampant, but is repressed and circumscribed ; therefore, the child does not feel the thrill that comes from shade of wood and breath of field, from song of bird and ripple of stream, from glow of sky and purity of air, these are all occasional and incidental.

Furthermore, in addition to being deprived of nature's influences, the impressions of human nature must be somewhat unwholesome and uninspiring when one is constantly surrounded with apparent means of defense, locked doors and fendered windows ; when one household knows not its nearest neighbor ; when the occupants of one flat are unacquainted with those of the flat below ; when one's comrade may be mere chance acquaintances when there is no place to romp and rove and revel and rejoice ; when the hard pavement and heavy brick wall debar one from close contact with the breast of mother earth.

And so it seems that the children of the city are deprived of the naturalizing influence of the country, while the children of the country are deprived of the humanizing influences of the city, each needs the other, and both make for complete life.

As we consider the boy on the farm, we find that he is in close communion with nature herself, knows her touch, reads her language, feels her life, and delights in her manifestations. The beauty of field and wood beautifies his life, and inspires him with noble aspirations. He studies her forces, phenomena and effects ; he learns the economy she practices

in her productions; he discovers the secrets of her laboratory so that he can double the single-petaled rose and make the sweet clover grow where the wild thistle flourishes. She speaks to him a varied language but he understands her.

Not only does he know the ways of the wary trout but he holds daily conferences with the birds, knows their songs and cries and calls, the material used in their home-building, and the secret coverts to which they fly for protection. He talks with the jaunty little nuthatch that clings to the tree bark with downward head, he scolds back at that bold thief of a blue jay that cries "thief" through the woods and is self-appointed as a sentinel to warn all living things of the approach of man.

He salutes the snipes and plovers in their journeyings back and forth from the Arctic to the Antarctic, he welcomes the bobolinks and orioles in May and says good-bye to the crows and wild geese in November. He can tell you all about his various feathered friends, whether they are those which he has observed, like the little restless winged hummer and the humble little robin whose only walk is a hop, or those concerning which he has studied, like the slow porpoise — like the penguin, the ocean-crossing frigate bird, the sun-defying eagle, and the horse out-stripping ostrich. But the boy on the farm becomes best acquainted with the animals, domestic and wild. Not only does he understand the freaks of the frisky squirrel, the secret paths of old squire woodchuck, the hiding places of the cunning coons, and the dark galleries of the sightless moles, but he is on the most intimate terms with all the farm animals. He understands them, they him. His whistle starts the cows and his call warns the sheep, the colt becomes amenable to his wishes and the dog feels his mood.

All become his friends and he the friend of all. He is careful of them, and they obedient to him. His finer human nature, the qualities of tenderness and mercy, are brought out by his dealings and friendships. You never hear of a real country boy docking in plume-like fashion a horse's tail, and rarely see one driving with an over-drawn check.

Although the boy on the farm is influenced and refined through nature he also receives the most substantial discipline through work and the training of animals. Not only does he become tender and true, happy and humane, through the beauty and influences of nature, and his companionship with the birds and animals, but the acquires the fundamental principles and habits of industry, thrift, integrity and leadership. Because the products of the field are grown and secured only by hard, patient labor, he learns the priceless lesson of the necessity and value of continuous toil. Because the strenuous

conditions of farm life constrain all to the practice of strict economy, he learns how to save and spend prudently. These lesson are fundamental to success in life.

A boy ought to have some specific task to perform—not those that are exacting and distasteful — but certain chores that he can easily do and which he is expected to perform daily, regularly, faithfully and willingly. This cultivates in him the prime virtues of punctuality, regularity and obedience.

Every boy and girl ought to have some fowls or an animal to feed and care for, so as to learn their nature and means of mastery.

A boy should have a plot of ground to till independently so as to become acquainted with the art of agriculture, the various kinds of soils, and their adaptability to different products. He should sell his own products, receive the revenue from the same, select and purchase his personal supplies, so as to become familiar with methods of business. He should be encouraged to save as much as he can consistently and to make deposits in the bank in order that he may be trained in economy and thrift.

These are the conditions, the influences and the training that make strong, sturdy men ; that make manly, intelligent citizens ; that make honest, successful business men and officials, eighty per cent of whom, in some cities, are country born and bred.

Also there is a larger training for country girls than for city girls. The question of domestics is grievous in our cities. I do not say "servants" because in a free country the word does not denote the proper relation between employer and employee, it detracts from the dignity of labor, hence should be eliminated.

Mothers with daughters cannot trust them in the kitchen with the help, and the mothers themselves, on account of the fictitious forms of society, cannot stay in their kitchens for the purpose of teaching their daughters. Consequently domestic science and the art of good housekeeping must be taught in the public schools so as to give some elementary training to the housewives of the future. It is rarely that you can find a city bred girl who is trained in the knowledge of home making on limited means. From the condition of things the country girls acquires the art. But on account of her opportunities she should be encouraged to exercise herself out of doors, to ride and romp, put on tan and ruddiness of cheek, to raise fowls, ride rake, cultivate garden, tend sheep and even break colts.

I recall an instance on the western side of this state in which a gentleman had a fine, high-spirited colt, that had

won the ribbon at the fair, which he desired his daughter to break for riding. She entered upon the task, came to a common acquaintance with the animal, fed and handled him and so familiarized him with her presence that she finally mounted him. After exercising him a few days in the yard, she ventured to the neighbors, and after a while made longer journeys. Once on returning she felt the girth gradually slack and loosen, the saddle slip, and unable both to control the colt and maintain her seat, she clung desperately to the mane. As she approached her home she shouted to her father to stop the colt, but he simply slid the carriage house door, through which the colt with rider rushed, and just inside she slipped and fell violently upon her hands and knees. The father caught the colt, calmed him, tightened the saddle, and then requested his daughter to remount. So with bleeding hands and bruised knees she mounted, rode out a mile or more and came back with the frightened animal subdued, quiet and tractable again. The father wisely considered the temporary bruises of his daughter slight in comparison to the damage to the colt in having his head in time of fright.

Next to the discipline that comes from hard work, perhaps the greatest discipline that comes to a boy is the reflex training that results from training animals. That which brings out the qualities of confidence, of self control, of mastery, comes through training something else. In all probability the marvelous powers of generalship displayed by Alexander the Great were aided in their bringing out by breaking the famous horse Bucephalus. Every boy on the farm ought to have a dog or a colt to train or a pair of steers to break. One day last summer my attention was attracted to a boy and a pair of steers on the street of one of our small cities. Such a sight in the streets of our country villages is not unusual, but it certainly was an unusual sight in that city. But the uncommonness of the spectacle was not so attractive as the apparent confidence of the steers in their master and his absolute unconsciousness that he was doing anything unusual. It was a sight to be admired and a scene for an artist. The steers were Holsteins, black with generous patches of white on shoulder and flank, a white crescent adorning the forehead of each, with evenly turned horns, their backs were straight, legs clean, rumps full, heads shapely and eyes as gentle as a dove's. They were a prize pair and handled by a prize boy. He was cleanly dressed, had guileless eyes, a wholesome face, lithe limbs, supple build and was a manly fellow who marched beside his steers with the same air of self-possession that a business man carries to his office. Later I saw the same boy on another street with his friends attached to a cart. As

they were about to meet one of those animal-scaring trolleys, he dismounted, stepped along to the yoke, and eased them by with the skill of a master. Although the boy was not more than twelve or thirteen years of age, that was a grander feat than to be classleader in any high school or college. It afforded him a better training than any years' training in a high school could give. He learned to be merciful to the beast, and at the same time developed his powers of command. It was necessary for him to exercise self-control which is always a prerequisite in controlling anything else. A noisy brawling boy cannot break steers any more than a nervous, excitable man can train a colt. A boy who has that calm mastery over himself, that quiet self-poise, that personality, that he can break steers, has in him the ability to influence a legislative assembly or to rule a state.

And so life on the farm is full, joyous, and abounding. It gives a charm that sanctifies drudgery, and makes all toil a pleasure. It affords a foundation of nature knowledge which is essential to future asociation with men. It develops the powers of gentleness, self-control and personality. It inculcates the principles of honesty, frugality and benevolence. It forms the habits of economy, thrift and honest industry. It makes for manliness and nobility of life.

But the country cannot get along without the city, nor the city without the country. Both are essential. They are interdependent and supplement each other. The country furnishes the landed wealth, the city the commercial wealth. The country furnishes the products, the city the market. The country furnishes the means, the city the end. The country furnishes the homes, the city the business. The country furnishes the training, the city the activity. The country furinshes the men, the city the opportunity.

But the country home today can give better opportunities than ever before. The bicycle and trolley have brought the city to the country and carried the country to the city. Rural mail delivery is becoming an established part of the government. The public library is now accessible to nearly all who wish to read. The "Outlook," the "Ladies' Home Journal" and the "Youth's Companion" can be weekly visitors. Consequently the farmer's family can be more independent than nabobs, and happier than millionaires. There are dangers to be avoided. Men should not become niggardly and close fisted and dry up the fountains of charity because times are hard. Women should not become dull and sad and oblivious to the duties of life through the everlasting treadmill of the kitchen. They should go out, see things, take in the world,

and learn that there are others who need light, cheer and sympathy.

In contrast are two women, one below here in this charming valley receives into her home a few summer boarders. Among them a young lady whose eyes had been opened, whose heart had been cheered, and whose life had been sweetened by nature. At the close of one August afternoon this lady was sitting under a tree, entranced with the glory of the fading day, the stretches of yellow fields, the darkening woods, the purpling peaks, all caressed by the sun angels of the eventide, and above all the gorgeous panoply of gold and blue, and purple and crimson with which the sun attires itself in final disappearance. The landlady seeing her boarder gazing intently westward rudely interrupted the lady's reverie by reminding her that there were no apples on cherry bushes.

Above here in the same valley a lady gazed up the long stretch of dusty road and saw a drove of cattle coming down. Behind them, running hither and thither, followed a boy. When opposite the house and as the cattle were loitering in the shade of the trees, he came to the door and asked for a glass of water. The lady invited him in and gave him something that is always dear to a boy's heart — a piece of apple pie and a glass of milk. She learned that he was an orphan and was working his way to Boston where he hoped to find employment. On his departure she gave him a testament and her blessing in kind words. Several years afterwards the Young Men's Christian Association of Boston, employed some young men to hold gospel meetings during their summer vacations. Into this same community a young man came, stood up, read from a little testament, and spoke warmly to those present. After the meeting he sought the home in question and there expressed his gratitude to the woman who years before spoke to him kind words and gave him a mother's blessing.

So, too, one can yield to the hard conditions of home life and neither see beauty not feel any sympathy, or can keep tender, sweet and thoughtful. It is in such a home that the spirit of love dwells and whose memory is ever fresh and fadeless.

So the fugitive years go hurrying by and the decadent days come on when life's learning is mildewed in the mind and its experiences merely a tale, when the spur to ambitious zeal becomes dull and earthly gains corrode and waste ; when the "bane and blessing, the pain and pleasure" are all past, then, just as David sighed for a draught from the old home well at Bethlehem, so do the affections turn back and in the dim chambers of the heart there will still remain the remembrance

of one place most beautiful and precious on account of childhood's blissful hours, a spot made dear and sacred by the memory of her whose counsel guides our hearts, whose benediction abides upon us, whose spirit is ever with us, who gave us earthly life and pointed the way to the eternal.

An original poem by C. W. Scarff of Burlington, "Let us magnify our calling."

Music was furnished by Leitzsinger's Orchestra, and Brattleboro Male Quartette.

LIST OF MEMBERS OF WOMAN'S AUXILIARY.

Mrs. Margaret M. Reed,	Burlington
Mrs. May H. Pitkin,	Marshfield
Mrs. Carrie A. Nelson,	Ryegate
Mrs. Annie Dodge,	Morrisville
Mrs. Mary A. Smith,	Morrisville
Mrs. D. D. Howe,	Burlington
Mrs. Mary R. Ralph,	Brookfield
Mrs. A. L. Walker,	South Woodstock
Mrs. Elinor T. Clark,	Brookfield
Mrs. E. P. Carpenter,	Waterford
Mrs. S. J. Hastings,	Passumpsic
Mrs. F. S. Collins,	Burlington
Mrs. George Crane,	Wilmington
Mrs. C. J. Bell,	Hardwick
Mrs. Luna S. Peck,	Burlington
Mrs. Maria Peck,	Hinesburgh
Mrs. L. R. Jones,	Burlington
Mrs. C. M. Winslow,	Brandon
Mrs. J. O. Sanford,	Stamford
Mrs. Mary Kibbe,	Brookfield
Mrs. Louis W. Clark,	Brookfield
Mrs. A. B. Manchester,	Randolph
Mrs. T. F. Betterley,	West Brattleboro
Mrs. C. H. James,	Cornwall
Mrs. I. T. Story,	Essex
Mrs. Alvira A. C. Ware,	Brattleboro
Mrs. Sarah J. R. Whitman,	Brattleboro
Mrs. Hazen,	Hartford
Mrs. Jennie Bronson,	East Hardwick
Mrs. Ida M. Pierce,	Brattleboro
1897.	
Mrs. Jennie L. Brock,	Barnet
Mrs. F. L. Smith,	Fletcher
Mrs. M. W. Clark,	Williston
Mrs. John Smith,	Newbury

1898.

Mrs. Jennie S. Bentley,	St. Albans
Mrs. M. A. Curtis,	Georgia
Mrs. M. B. Fuller,	Georgia
Mrs. C. E. Martin,	Rochester
Mrs. E. W. Smith,	East Berkshire
Mrs. E. R. Towne,	Waterbury
Mrs. R. B. Galusha,	Jericho
Mrs. H. M. Crane,	St. Albans
Mrs. O. T. Sunderland,	Georgia
Mrs. M. L. Aseltine,	North Fairfax
Miss Elma Eldred,	Sheldon
Mrs. E. M. Denny,	Montpelier

1899.

Mrs. Fanny A. Drew,	St. Johnsbury
Mrs. C. H. Higgins,	St. Johnsbury
Mrs. Alma F. Waters,	St. Johnsbury
Mrs. Mary A. Brackett,	St. Johnsbury
Mrs. Genevieve Snow Davis,	North Pomfret
Mrs. Bessie H. Strong,	North Pomfret
Mrs. S. A. Vail,	North Pomfret
Mrs. I. C. Houghton,	Lyndon
Mrs. L. F. Bickford,	Bradford
Mrs. L. H. Davis,	Bradford
Mrs. J. E. Bass,	Randolph

NAMES OF NEW MEMBERS FOR 1900.

Mrs. Edward C. Smith,	St. Albans
Mrs. Jennie S. Wood,	Winchester, N. H.
Mrs. Sophia B. Craddock,	Brattleboro
Mrs. Ellla A. Eames,	Brattleboro
Mrs. Almira L. C. Robbins,	Brattleboro
Mrs. Susan F. Lowe,	Barttleboro
Mrs. H. D. Thayer,	Barttleboro
Mrs. M. I. Reed,	Vernon
Mrs. W. C. Cushing,	Vernon
Mrs. A. A. Mason,	Townshend
Mrs. E. B. Batchelder,	Townshend

ALVIRA A. C. WARE, Secretary,
Brabttleoro.

LICENSED OPERATORS OF THE BABCOCK TEST.

The following list shows the names, addresses and license numbers of parties who have been licensed between May 8, 1899 and March 22, 1900, in accordance with Section 2 of No. 81 of the Acts of 1898. The names, addresses and number of parties licensed prior to May 8, 1899, 222 in number, will be found on pages 119-123 of the last (twenty-ninth) report of this Association.

Section 2. Each and every person who, either for himself or in the employ of any other person, firm or corporation, manipulates the Babcock test, or any other test, whether mechanical or chemical, for the purpose of measuring the contents of the butter fat in milk or cream as a basis for apportioning the value of milk or cream, or the butter or cheese made from the same, shall secure a certificate from the superintendent of the dairy school of the University of Vermont and State Agricultural College that he or she is competent and well qualified to perform such work. The rules and regulations in the application for such ecrtificate and in the granting of the same shall be such as the superintendent of the school may arrange. The fee for issuing such ecrtificate shall in no case exceed one dollar, the same to be paid by the applicant to the superintendent of the dairy school and be used by the superintendent in meeting the expenses incurred under this Section.

PRO RATA AND LICENSED OPERATORS.

Aiken, Wm. H.	East Ryegate,	261
Allen, Geo. A.	West Hartford,	262
Baylor, J. P.	East Fairfield,	267
Bradley, E. C.	Oakland,	257
Brittell, Edw. J.	Lincoln,	234
Brothers, E. H.	North Montpelier,	281
Cameron, L. M.	Montpelier,	252
Carpenter, N. B.	Waitsford,	247
Casey, F. M.	Colchester,	250
Chase, Thos. J.	Hartland,	248
Churchill, H. O.	Cambridge,	224
Clarke, H. W.	West Glover,	277
Coburn, W. G.	Marshfield,	264
Cree, Fred N.	Plainfield,	236
Donaway, Edw. W.	Vergennes,	279
Eno, R. W.	Charlotte,	276
Estell, F. A. M.	Newport Centre,	273
Franklin, Chas. A.	Whitingham,	241
Fish, H. Z.	Bellows Falls,	235

Fisher, Dean W.	East Peacham,	254
Gleason, J. L.	Warren,	242
Goss, L. F.	Greensboro,	274
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Hayward, Fred R.	Washington,	238
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Hooper, Joel A.	North Cambridge,	271
Jackson, Bernard	Ludlow,	232
Jacobs, Fred A.	Shelburne,	275
Kidder, W. J.	Enosburg,	282
Leonard, W. B.	Barton Landing,	249
Little, Chas. H.	North Montpelier,	244
Marcy, G. F.	Montgomery Centre,	239
Mitchell, E. O.	Glover,	260
Moran, M. R.	Derby,	227
Morse, F. P.	South Royalton,	223
Morse, L. O.	Island Pond,	225
Morse, Mary E.	Randolph,	251
Nay, G. W.	Montpelier,	240
Nelson, David	Cabot,	246
Nelson, H. F.	East Hardwick,	237
Newton, W. G.	Essex,	278
Noble, W. A.	Warren,	283
Palmer, B. L.	Waitsfield,	228
Parker, J. E.	East Burke,	259
Perrin, O. H.	Fairlee,	265
Perry, H. S.	Woodstock,	255
Phillips, W. L.	Enosburg Falls,	272
Roberts, Geo. V.	Shoreham,	266
Robinson, M. C.	Fairlee,	269
Sanborn, H.	South Peacham,	245
Scruton, A. J.	East Topsham,	280
Spaulding, Perley	Bethel,	229
Temple, G. H.	Randolph Centre,	230
Thayer, L. O.	Bethel,	233
Tichurst, A. W.	West Glover,	270
Weed, C. H.	Essex,	226
Wells, A. C.	Randolph,	258
Wilcox, Fred	Fairlee,	243
Williams, S. W.	Bradford,	281
Wolcott, P. B.	Cream Hill,	231
Wright, Spencer	Bristol,	268

1900

LIST OF CREAMERIES AND CHEESE FACTORIES, STATE OF VERMONT.

ADDISON COUNTY CREAMERIES.

New Haven Mills Co-op Cr'y Co.,	New Haven Mills
Reef Bridge Cr'y Asso., Co-op.,	Weybridge
Ferrisburgb Creamery Co., Co-op.,	Ferrisburgh
Allen Creamery, Proprietarh,	North Ferrisburgh
Cream Hill Creamery, Proprietary,	Creamhill
Champlain Valley Creamery, Proprietary,	Creamhill
Elgin Spring Creamery, Co-op.,	Vergennes
Cloverleaf Creamery,	Orwell
Green Mountain Cold Spring Cr'y Asso., Co-op.,	Starksboro
Bristol Riverside Creamery, Co-op.,	Bristol
T. H. Armstrong Creamery,	Leicester Junction
East Monkton Creamery Asso., Proprietary,	East Monkton
North Cornwall Creamery, Proprietary,	Middlebury
West Panton Co-op Creamery,	Vergennes
Needham Creamery, Proprietary,	Vergennes
South Starksboro Co-op Creamery,	South Starksboro
Vergennes Creamery Company, Co-op.,	Vergennes
Middlebury Co-op Creamery Asso.,	Middlebury
Lincoln Co-op Creamery,	Lincoln
Fair Valley Creamery,	Weybridge

ADDISON COUNTY CHEESE FACTORIES.

Orwell Cheese Factory Co., Co-op.,	Orwell
Shoreham Cheese M'f'g Co., Proprietary,	Shoreham
Beaver Glen Factory, Proprietary,	'New Haven
Champlain Valley Cheese Factory, Proprietary,	Bridport
Farmingdale Cheese Co., Co-op.,	East Middlebury

BENNINGTON COUNTY CREAMERIES.

Stamford Elgin Butter Co., Co-op.,	Stamford
South Shaftsbury Cr'y Asso., Co-op.,	South Shaftsbury
Elgin Creamery Asso.,	Readsboro

BENNINGTON COUNTY CHEESE FACTORIES.

Battenkill Cheese Factory Asso., Co-op.,	Manchester Center
East Rupert Dairy Asso., Co-op.,	East Rupert

Rupert Dairy Asso., Co-op.,	Rupert
Rose Cheese Factory, Proprietary	West Rupert
East Dorset Cheese Asso.,	East Dorset
Dorset Cheese Asso., Co-op.,	Dorset
Green Mountain Cheese Factory, Co-op,	Bondville
Peru Cheese Co., Co-op,	Peru
Mettowee Cheese Factory,	East Rupert
Dolly Varden Cheese Factory,	West Rupert
Denio Cheese Factory, Proprietary,	North Rupert

CALEDONIA COUNTY CREAMERIES.

Walden Creamery, Co-op,	South Walden
Lamoille Valley Creamery Asso., Co-op.,	East Hardwick
Farmers' Mutual Creamery Co., Co-op.,	St. Johnsbury
Passumpsic Creamery Asso., Co-op.,	Passumpsic
North Ryegate Co-op Creamery Co.	Groton
Trout Brook Creamery Co., Co-op.,	West Waterford
Danville Creamery Asso., Co-op.,	Danville
South Peacham Co-op Creamery Co.,	South Peacham
Noyesviile Co-op Creamery Asso.,	Walden
South Ryegate Co-op Creamery Asso.,	South Ryegate
East Ryegate Co-op Creamery Co.,	East Ryegate
Sheffield Co-op Creamery Asso.,	Sheffield
Burke Creamery Co., Co-op.,	Burke
Jersey Hill Creamery Co., Co-op.,	Ryegate
Barnet Creamery Asso., Co-op.,	Barnet
Lyndonville Creamery Asso., Proprietary,	Lyndonville
East Peacham Creamery, Co-op.,	East Peacham
Jersey Home Creamery, Proprietary,	East Burke

CHITTENDEN COUNTY CREAMERIES.

Colchester Co-op. Butter and Cheese Factory Co.,	Colchester
Towers Creamery, Proprietary,	Richmond
Cloverdale Creamery Co., Stock Co.,	North Underhill
Winooski Valley Co-op. Cr'y	North Williston
Shelburne Co-op. Cr'y Co.,	Shelburne
Lake View Creamery Co., Co-op.,	Charlotte
Oak Hill Co-op. Creamery Asso.,	Talcott
Valley Falls Creamery, Co-op..	Hinesburg
Queen City Creamery, Proprietary,	Jericho
Clover Hollow Creamery, Proprietary,	Essex
Lake Champlain Creamery, Proprietary,	Essex Junction
Jonesville Creamery Asso.,	Jonesville
Crystal Spring Creamery Co.,	East Charlotte
G. M. Norton & Co. Creamery,	Hanksville
Richmond Co-op. C'ry Asso.,	Richmond

Williston Co-op. Cr'y Asso.,	Williston
G. M. Norton's Creamery,	Huntington
Green Mountain Creamery,	Huntington Centre
Vermont Condensed Milk Co.,	Richmond
Lee River Creamery,	Jericho Center
Milton Hollow Creamery, Proprietary,	Milton
West Milton Co-op. Creamery,	West Milton
Beaver Brook Farm Creamery, Proprietary,	West Bolton
F. Allen Creamery,	Westford

CHITTENDEN COUNTY CHEESE FACTORIES.

Union Cheese Factory Co-op.	Brookside
Brown's River Cheese Factory Co. (Stock Co.)	Essex Center
MacDonough Cheese Factory, Proprietary,	Hinesburgh

ESSEX COUNTY CREAMERIES.

Hobson Creamery, Co-op.,	Island Pond
Morse River Creamery Co., Co-op.,	Gallup Mills
Lunenburg Co-op. Cr'y Assn.,	Lunenburg
Concord Creamery, Proprietary,	West Concord

FRANKLIN COUNTY CREAMERIES.

Franklin County Cr'y Assn., Proprietary,	St. Albans
Marcy's Creamery, Proprietary,	Montgomery Center
Clover Leaf Creamery, Proprietary,	Fletcher
Maple Leaf Creamery, Proprietary,	Morse's Line
Star Creamery, Proprietary,	Binghamville
North Sheldon Creamery, Proprietary,	North Sheldon
Oakland Creamery, Proprietary,	Oakland
Sheldon Creamery,	Sheldon
North Georgia Cr'y and Cheese Factory, Proprietary,	North Georgia
Green's Corners Creamery, Proprietary,	Swanton
Maple Creamery, Proprietary,	Highgate

FRANKLIN COUNTY CHEESE FACTORIES.

Green Valley Cheese Factory, Proprietary,	East Swanton
Milton Bros. Cheese Factory (Proprietary but run as Co-op.)	Georgia Plain
Fairfax Cheese Factory, Proprietary,	Fairfax
St. Rox Cheese Factory, Proprietary,	Fairfield

GRAND ISLE CREAMERIES.

Grand Isle County Co-op. Creamery Assn.,	Pearl
North Hero Creamery, Proprietary,	North Hero
South Hero Creamery Assn., Co-op.,	South Hero
Alburgh Creamery, Proprietary,	Alburgh

Holland Creamery Assn., Co-op.,	Holland
Mill Village Creamery Co., Proprietary,	North Craftsbury
Green Mountain Creamery Co., Proprietary,	Westfield
Willoughby Creamery, Proprietary,	Barton Landing
Lowell Creamery, Proprietary,	Lowell
Evansville Co-op., Creamery Assn.,	Evansville
Mill Village Creamery and Cheese Factory,	Irasburg
Glover Creamery Co., Co-op.,	Glover
Caspian Lake Creamery Co., Co-op.,	Greensboro
West Charleston Creamery Co., Proprietary,	West Charleston
Albany Creamery, Proprietary,	West Albany

ORLEANS COUNTY CHEESE FACTORY.

Orleans County Cheese Factory, Proprietary,	North Troy

RUTLAND COUNTY CREAMERIES.

Middletown Cheese and Butter Co., Co-op.,	Middletown Springs
The Marshall Creamery, Proprietary,	North Clarendon
Benson Creamery, Proprietary,	Benson
Champlain Valley Creamery, Proprietary,	Fair Haven
Lake Side Creamery, Proprietary,	Mechanicsville
Rutland County Creamery, Proprietary,	Pittsford
Otter Creek Creamery,	Sudbury
Wallingford Creamery, Proprietary,	Wallingford
Lake Hortonia Creamery Co., Proprietary,	Hortonville
Hudson Valley Creamery Co.,	Poultney
Rutland Creamery,	Rutland
S. C. Gorham's Creamery,	West Rultand
Nickwackett Creamery,	Pittsford
Pittsford Creamery, Proprietary,	Pittsford
L. A. Russell Creamery,	Cuttingsville
Castleton Creamery,	Castleton

RUTLAND COUNTY CHEESE FACTORIES.

J. D. S. Packer Cheese Factory, rented to Boston Dairy Co.,	Mt. Holly
Tarbell Cheese Factory, Proprietary,	Mechanicsville
East Poultney Cheese Mfg. Co., Co-op.,	East Poultney
West Pawlet Dairy Co., Co-op.,	West Pawlet
Mt. Holly Cheese Factory, Proprietary, milk shipped to Boston,	Mt. Holly
Smithtown Cheese Factory Co., Co-op.,	West Rutland
Gleason Cheese Factory, Proprietary,	Shrewsbury
Flower Brook Cheese Factory, Proprietary,	Pawlet
Peter Pelkey's Cheese Factory, Proprietary,	East Wallingford
Riverside Cheese Factory, Co-op.,	Ira
Eureka Cheese Factory, Proprietary,	Wells

Condensed Milk Co., F. W. Shepardson,	Richmond
Samson Co-op. Creamery Co.,	Grand Isle
Home Dairy Creamery,	East Alburgh

LAMOILLE COUNTY CREAMERIES.

Mt. Mansfield Creamery, Proprietary,	Stowe
Bell Brook Creamery, Proprietary,	East Johnson
Cambridge Creamery, Proprietary,	Cambridge
Hyde Park Creamery, Proprietary,	Johnson
Gihon Creamery, Proprietary,	Johnson
Riverside Creamery, Proprietary,	Wolcott
Jersey Heights Creamery, Proprietary,	Morrisville

ORANGE COUNTY CREAMERIES.

Bradford Creamery Co., Owned by Lyndonville Creamery Association,	Bradford
Hillside Creamery, Proprietary,	Bradford
Randolph Creamery, Proprietary,	Randolph
North Thetford Creamery Co., Co-op.,	North Thetford
Randolph Co-op. Creamery Co.,	Randolph
Vershire Creamery Co., Co-op.,	Vershire
Orange County Creamery Co., Co-op.,	Chelsea
Washington Creamery Association, Co-op.,	Washington
Topsham Co-op. Creamery Co.,	Topsham
Wachusett Creamery Co., Proprietary,	West Brookfield
Wells River Creamery Co,. Co-op.,	Wells River
West Braintree Creamery, Proprietary,	West Braintree
Corinth Creamery Co., Co-op.,	Corinth
East Corinth Creamery Co., Co-op.,	East Corinth
Lake Morey Creamery,	Fairlee
Strafford Creamery Co., Stock Co,	Strafford
Newbury Creamery Co., Co-op.,	Newbury
Green Mountain Creamery Co., Co-op.,	West Topsham
Temple Creamery, Proprietary,	Randolph Centre
East Topsham Creamery Co.,	East Topsham
E. H. Thayer's Creamery,	West Brookfield

ORANGE COUNTY CHEESE FACTORY.

Brookfield Cheese Factory, Proprietary	Brookfield

ORLEANS COUNTY CREAMERIES.

Clyde River Creamery Co-op.	East Charleston
Highland Creamery Co-op.	Derby
Meadow Brook Creamery, Proprietary,	West Glover
Black River Creamery, Co-op.,	Coventry
Black River Cheese and Butter Co., Proprietary,	Craftsbury

Blakely Cheese Factory, Proprietary,	Pawlet
East Pittsford Cheese Factory, Proprietary,	East Pittsford
Lewisville Cheese Factory, Proprietary but governed as Co-op.,	Wells
Chippenhook Cheese Factory, Co-op.,	Chippenhook
Hillside Cheese Factory,	Danby Four Corners
Lake Side Butter and Cheese Factory, Proprietary,	Mechanicsville
W. E. Aldrich Cheese Factory, Proprietary,	North Shrewsbury
Maple Grove Cheese Factory, Proprietary,	Pawlet
Gilt Edge Cheese Factory, Co-op.,	East Hubbardton
W. E. Edson Cheese Factory,	East Pittsford
F. F. Peters Cheese Factory,	Ira
Union Cheese Factory,	South Wallingford
The A. W. Crowley Cheese Factory,	Healdville
Spring Valley Cheese Co.,	Middletown Springs
Bates Cheese Factory,	Shrewsbury
Cold River Cheese Factory, Proprietary,	Cold River
Vt. Cheese Factory, Co-op., milk shipped to Boston at present,	East Wallingford
Hoskison Cheese Factory, Proprietary, milk shipped to Boston,	Healdville

WASHINGTON COUNTY CREAMERIES.

Cabot Creamery Co., Co-op.,	Cabot
Cold Spring Creamery, Proprietary,	Moretown
Waitsfield Creamery Co., Co-op.,	Waitsfield
Plainfield Creamery Co., Co-op.,	Plainfield
Marshfield Co-op., Creamery Assn.,	Marshfield
Shady Rill Co-op., Creamery Co.,	Montpelier
North Montpelier Co-op., Creamery Co.,	North Montpelier
Capitol Creamery, Proprietary,	Montpelier
Clovervale Creamery, Proprietary,	Waterbury
Mad River Valley Creamery, Proprietary,	Waitsfield
East Calais Creamery Co.,	East Calais
East Montpelier Co-op., Creamery,	East Montpelier
Waterbury Creamery, Proprietary,	Waterbury
Warren Co-op. Creamery,	Warren
Walker Farm Creamery, Proprietary,	Montpelier
Summit Creamery, Proprietary,	Roxbury
Cloverdale Creamery,	Northfield
F. Batchelder and Co., Creamery,	Waterbury

WINDHAM COUNTY CREAMERIES.

Deerfield Valley Creamery Assn., Co-op.,	Wilmington
Mount Lake Creamery Assn., Co-op.,	South Londonderry
Putney Creamery Assn., Co-op.,	Putney
Brattleboro Creamery Assn., Co-op.,	Brattleboro

Mount Lake Farm Creamery, Proprietary,	North Londonderry
North River Creamery Assn., Co-op.,	Jacksonville
Windham County Creamery, Co-op.,	Newfane
Valley Creamery Assn., Coop.,	Westminster

WINDSOR COUNTY CREAMERIES.

Springfield Co-op., Creamery Co.,	Springfield
White River Creamery, Proprietary,	Rochester
West Hartford Creamery Assn., Co-op.,	West Hartford
Storrs Creamery, Proprietary,	East Bethel
Maple Creamery, Co-op.,	Woodstock
Oak Leaf Creamery, Proprietary,	Chester
Sherburne Creamery, Proprietary,	North Pomfret
Harrington Creamery, Proprietary,	Bethel
Sharon Creamery Assn., Co-op.,	Sharon
Waldo Creamery,	South Royalton
Woodstock Creamery, Proprietary,	Woodstock
Bethel Lympus Co-op., Creamery Assn.,	Bethel
Brookside Creamery, Proprietary,	Hartland Four Corners
Howard Creamery, Proprietary,	West Hartford

WINDSOR COUNTY CHEESE FACTORIES.

Weston Cheese Co., Co-op.,	Weston
Chester Cheese Co., Co-op.,	Chester
The Ludlow Cheese Co., let to Boston Dairy Co.,	Ludlow
Simonsville Cheese Factory, Co-op.,	Simonsville
Andover Dairy Assn., Co-op.,	Andover
West Windsor Cheese M'f'g Co., Co-op.,	Brownsville
East Barnard Cheese Co., Co-op.,	East Barnard
Excelsior Cheese Factory, Proprietary,	South Reading
Gassetts Cheese Co., Co-op.,	Gassetts
Plymouth Cheese Factory, Proprietary,	Plymouth

UNIVERSITY OF VERMONT

AND STATE AGRICULTURAL COLLEGE

VERMONT AGRICULTURAL

EXPERIMENT STATION

BURLINGTON, VT.

BULLETIN No. 81

SEPTEMBER, 1900

Principles and Practice of Stock Feeding

BURLINGTON:
Free Press Association, Printers and Binders.
1900.

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☞Copies of the reports and bulletins of the Station are sent free of charge to any address upon application.

☞Address all communications, not to individual officers, but to the Agricultural Experiment Station, Burlington, Vt.

Director's office, chemical and horticultural laboratories are at the Experiment Station building, at the head of Main Street; botanical and entomological laboratories are at Williams Science Hall, University Place.

Experiment Farm and buildings are on the Williston road, adjoining the University grounds on the East.

BULLETIN 81: PRINCIPLES AND PRACTICE OF STOCK FEEDING

By J. L. Hills

I. TABLE OF CONTENTS AND SUMMARY.

1. TABLE OF CONTENTS.

2. SUMMARY

II. *Animal nutrition.* **The animal body is made up of water, ash, protein and fat; vegetable matter, of the same ingredients, together with crude or woody fiber, and nitrogen-free extract (starch, sugars,**

gums, etc.) The latter two (crude fiber and nitrogen-free extract) are often called carbohydrates. In compounding rations, protein, carbohydrates and fat are the main nutrients to be considered.

The main function of protein is to form flesh. It may under some circumstances form fat, produce heat and furnish material for energy production. It seems to be a milk stimulant. The functions of the carbohydrates and fat are to produce heat, muscular energy, body, and, perhaps milk fat, and to protect the protein from over-consumption.

The digestibility of food is variously affected by sundry conditions of the animal and its feed. The several nutrients are assimilated in quite different proportions when in different combinations. The determination of these proportions is the aim of digestion experiments.—Pages 5-14.

III. *Feeding standards.* These are of three sorts, the physiological, the practicable and the average standards. The first are not absolute rules but average estimates based on the present knowledge of the physiological needs of farm stock. They consider maximum yield only. The second are variables, take cognizance of costs of raw material and of product, and are the result of the experience, observation and study of the individual feeder. The third are simply the expression of average feeding practice, apart from considerations of adaptation or profit.

The standards are many in number and have been proposed by sundry German and American investigators. They are useful as guides rather than as rules. Any standard is better than none Choice will vary in accordance with sundry considerations. They may be made use of in calculating a ration or in planning a season's feeding campaign.—Pages 14-29.

IV. *Sundry economic considerations.* A classification of the more common roughages and concentrates aids in indicating their values in ration making. In making sales and purchases the main point to bear in mind is to sell so far as practicable carbon, hydrogen and oxygen, air-given elements, and to buy nitrogen, phosphoric acid and potash, soil-derived ingredients readily lost through cropping. A second point hardly less important is to make one's farm a carbohydrate factory and to seek supplementary protein at the feed store.

While the exact expression of the money values of sundry grain feeds on any common basis is impossible, an approximation to such an expression may be made. The results are not absolute and have on the whole a somewhat doubtful value. The percentage of digestible protein is the primal consideration in dairy feeding. Pages 29-37.

V. *Appendix* contains a glossary and tables showing the sundry standards, the composition and digestible ingredients of the several fodders and feeds fed in New England and a convenience table which simplifies the mathematics of calculating a ration.—Pages 37-56.

INTRODUCTION

No general statement as to the laws of nutrition and the results of experience in cattle feeding has been made in the publications of this station since 1887. There is so much call for information on these matters that it has been thought wise to attempt in some measure to meet the demand by a popular presentation of present knowledge. The opportunity to do this is afforded by the passage by the legislature of 1898 of a law placing $1000 at the disposal of the station for printing. Had it not been for this appropriation the publication of a bulletin so entirely devoid of the results of original investigation, so purely a matter of compilation, would hardly have been deemed a justifiable use of the national funds. The United States appropriation is spent in accordance with the terms of the law for investigation and research rather than in purveying general agricultural information.

The writer has tried to state matters clearly and so far as possible has avoided the use of technical terms. Such as are used are defined. (See pages 7 and 8, also glossary, pages 38-39). The reader is reminded, however, that the natural laws underlying stock feeding and man's experience therein are not kindergarten subjects, but that careful study is needed if their mastery is sought. No excuse is offered for the prominence given to dairying. Examples and illustrations are all taken from dairying practice. To cover all the branches of stock feeding would be to write a book.

II. ANIMAL NUTRITION

1. COMPOSITION OF THE ANIMAL BODY

The animal body contains many complex substances but they may for present purposes be grouped as follows: water, ash or mineral matter, protein, and fat.

1. *Water* is the main constituent in point of quantity. It comprises from 40 to 85 per cent of the gross weight, varying according to age and condition. While indispensable to the life functions, water has but little economic importance in this connection.

2. *Ash* (mineral matter, bony matter) is a term applied to the residue or ashes left after complete burning. Bones contain much ash and other tissues carry small quantities, making in all 2 to 5 per cent of the gross weight. It is largely phosphate of lime. While obviously essential to proper animal growth, ash exists in plentiful quantities in most rations and hence, like water, may be dismissed from further consideration.

3. *Protein* (the nutrient which forms flesh) is a term applied to a somewhat miscellaneous group of nutrients which are alike in that they all contain from 12 to 19 per cent nitrogen. Three main sub-groups are recognized in animal proteins, the albuminoids, the gelatinoids (collagenes) and the nitrogenous extractives. The *albuminoids* are the most im-

portant of these. The white of the egg, the dry lean meat of muscle and the casein of milk are albuminoids. The *gelatinoids* make up the elastic gelatinous part of bones, cartilages. tendons etc. The *extractives* form the basis of meat extracts, beef teas, etc. The flesh, skin, bones (in part), vital organs, brain, nerves, in fact the bodily mechanism, are made up of protein, diluted, so to speak, with water, supported by the ash of the skeleton and rounded out with fat. It is obvious that protein is of the utmost importance.

4. *Fat* is distributed ordinarily all over the body, and comprises from 6 to 30 per cent of the live weight in different classes of animals. It consists of carbon, hydrogen and oxygen but contains no nitrogen. While not as vitally necessary to animal life as the other three ingredients, it has much economic interest.

These various substances are formed from the animal, vegetable and mineral matters known as food, and are converted by the animals eating them, into flesh, fat, bone, milk, wool, and work (energy).

2. COMPOSITION OF VEGETABLE MATTER

Since the biblical statement that "all flesh is grass" is scientifically correct, it follows that there is similarity between the constituents of animal and vegetable matter. The groups of ingredients cited under the previous heading—water, ash, protein and fat—are found in feeding stuffs, as are also crude fiber (cellulose, woody tissue) and nitrogen-free extract (starch, sugars, gums, pentosans, etc.) The individual substances which comprise the groups when they are of vegetable origin are somewhat different from those in the animal body, but these variations are not important to present purposes.

Water, ash and true fat are quite alike, whether lodged on an animal's frame or in a cornstalk.

The *nitrogenous matters*—other than nitrates, alkaloids, etc., which are sometimes present in small quantities—are protein (albuminoids), and amides and allied bodies. The gluten of wheat, which furnishes the dough-making property of flour, is a typical vegetable protein. It exists in considerable quantities in seeds and their byproducts. The amides, etc., have less food value than the true protein. They are essentially protein in process of transportation and transition.

The so-called *fat* of fodders and feeds is impure, being fat mixed with wax, resins, chlorophyll (the green coloring matter of plants) etc. These ingredients are all extracted from a fodder by boiling ether, hence the term in common usage, *ether extract.*

Crude fiber, (sometimes called woody fiber or cellulose) makes up the cell walls, the frame-work of the mature plant. Hay and straw, and the hulls of many seeds contain a quarter part or more, while trees consist mainly of

crude fiber and kindred substances. Cattle and sheep digest it fairly well, other animals but slightly.

Nitrogen-free extract is a term applied to a somewhat miscellaneous group of nutrients, none of which contain nitrogen, and all of which are dissolved by dilute solvents. Its principal constituents are starch, sugars, gums and similar substances. Starch is usually more abundant than the others and the group on this account is sometimes called "starchy matter." The nutritive functions of crude fiber and of the nitrogen-free extract are similar, hence the collective term in common usage, *carbohydrates*, is in many ways preferable.

Since enough ash is present in almost all rations to meet bodily needs, and since water is otherwise supplied, in compounding rations the feeder has to do only with *protein, fat and carbohydrates.*

SUNDRY DEFINITIONS

Certain terms in common use in food analysis or in the discussion of nutrition are defined at the outset that their meaning may be the more clearly apprehended.

Dry matter, organic matter, digestible dry matter are collective terms. Neither represents any single group of nutrients. The first designates the material—whatever its nature—left when all the water it contains is vaporized. For instance silage containing 75 per cent of water carries 25 per cent of dry matter. Organic matter is dry matter less its ash, or, in other words, it is the portion which disappears in burning. In the case just cited nine-tenths or thereabouts of the 25 per cent dry matter would burn off and would be the organic matter. Digestible dry matter is the portion which is capable of solution by the sundry digestive juices and is available as food. It is the true food, the remainder being useless except as it enriches the manure.

Nutrient and nutritive ratio are terms in frequent use. A nutrient is a digestible ingredient of food, one capable of performing one or more of the food functions. Ash, protein, fat and carbohydrates are nutrients.

The term nutritive ratio is less readily defined. The primary function of protein is quite different from that of the other nutrients (pages 8–9). On this account the relation of the amounts of protein and of carbohydrates fed to the object in view, as well as to economy in feeding, is of importance. The nutritive ratio shows this in figures. It is the mathematical expression of the relation of the amounts of digestible protein and of the other nutrients to each other in a given ration. It is a ratio, a proportion, 1:6 or 1:8, the two terms of which are (*a*) digestible protein and (*b*) digestible carbohydrates and fat. If there be 2 pounds of *a* and 12 pounds of *b* the nutritive ratio will be determined by the common rules of proportion, 2: 12: : 1: 6, there being 6 times as much digestible carbohydrates and fat as

protein. Since a pound of fat has from 2.25 to 2.5 times the fuel value of a pound of carbohydrates, it is customary in calculating nutritive ratios to multiply the weight of fat by 2.25, 2.4 or 2.5 and to add the result to the weight of the fiber and extract matter.

Nutritive ratios are termed "narrow," "medium" and "wide." A wide ratio is one affording a relative excess of digestible carbohydrates and fat, a narrow one, comparitively small amounts of these ingredients. Oat straw, for instance, is poor in protein and rich in carbohydrates; cotton-seed meal, the reverse. The nutritive ratio of the straw is wide,—1:38.3; of the meal, narrow,—1:1.0. The method of calculating nutritive ratios is as follows: The amounts of digestible protein, carbohydrates and fat being known by the use of tables of analyses, and digestion coefficients (pages 43-49), the amount of digestible fat multiplied by 2.25 is added to the amount of digestible carbohydrates and the total divided by the amount of digestible protein. For example 0.4 pounds fat, 13.5 pounds carbohydrates, 2.3 pounds protein; $0.4 \times 2.25 = 0.9$; $13.5 + 0.9 = 14.4$; $14.4 \div 2.3 = 6.3$. Nutritive ratio =1:6.3, there being 1 part of digestible protein to every 6.3 parts of digestible carbohydrates and fat.

Calorie is a term used to express the fuel value or heat value of a material. A "calorie" is the amount of heat required to raise the temperature of a pound of water about 4° F.

3. FUNCTIONS OF NUTRIENTS

Food as a whole may be defined as any material which is capable of forming or of repairing tissue, or of yielding energy. It may perform either or all of these functions and still be food.

The *water* content of feeds is a secondary consideration and may be disregarded.

The *ash* supplies the mineral portion of the bone and furnishes minute proportions to other tissues. Plentiful amounts are usually present to meet most demands. In exceptional cases, such, for instance, as young animals, hogs exclusively corn fed, laying hens, etc., carbonate of lime (oyster shells, chalk), woodashes, or ground bone form a desirable addition to the ration because of the ash which they contain.

Protein, as has already been pointed out, differs from the other nutrients in that it is the "flesh former," the machine-maker, the repairer of wear and tear. It may, like the other nutrients, be used as fuel to run the machinery, but this is not a wise or economical use of this most costly nutrient.

The functions of protein are five fold:

1. From it are formed flesh, tendons, cartilage, etc., and the nitrogenous part of milk (casein, albumen, etc.)

2. It forms body fat, and perhaps at times milk fat.

3. It furnishes material for the production of heat to maintain the warmth of the body.

4. It furnishes material for the production of muscular energy.

5. It is held by some to be a stimulant to milk production.

Let us consider these somewhat more in detail.

1. The primary function of protein is that of tissue-building. This tissue may be the flesh of a growing animal, the repaired or, rather, replaced flesh of a mature beast, the wool of a sheep, or the milk of a cow, which in part at least is made from broken down udder tissue. Without protein no flesh, hair, wool, or milk can be made. Animals fed on materials devoid of this nutrient have starved in the midst of plenty.

2, 3, 4. The three functions of (2) fat formation, (3) heat making, and (4) the production of muscular energy are usually performed by the fat and carbohydrates of the food. If, however, these are insufficient in amount, protein may be consumed in their stead. Such shortage rarely occurs in cattle feeding except when a ration is deficient in all the nutrients, that is to say when animals are being partially starved. Similarly protein may be used instead of fat or carbohydrates if it is fed in excess of what is needed for making tissue or replacing waste. The protein thus used may be that of the food, or that of the body, i. e. flesh. The more is fed, the more is destroyed by the vital processes, if fed in excess of requirements. These three functions, however, may very properly be termed the secondary functions of protein, since these offices can be performed more successfully and more cheaply by the carbohydrates ; and, as has been already observed, in ordinary feeding practice they are more commonly thus performed.

5. It has long been known that, within certain limits, the more highly nitrogenous the ration, the greater its value as a milk maker. Protein, in other words, seems to act somewhat in the manner of a milk stimulant. Average milk carries from 3 to 3.5 per cent albuminoids. A cow giving 30 pounds of milk a day yields therein a pound of protein (casein and albumen). The fat and milk sugar may be formed otherwise, but casein and albumen can only result from protein feeding. The protein content of a ration more than any other one thing governs its effect upon the milk flow.

Carbohydrates and fat are so similar in their office in feeding that they may be considered in this connection as one. Their functions are five. They furnish material for the following purposes :

1. The production of heat.
2. The production of muscular energy.
3. The formation of body fat.
4. The protection of the flesh of the body from too rapid breaking down as a result of vital processes.
5. The carbohydrates are probably a main source of material for the manufacture of milk fat.

There is no one function of the carbohydrates and fat which, like the flesh forming function of the protein, can be considered of more consequence than the others ; all are of the utmost importance to the animal economy.

Let us now consider each of these five functions in more detail.

1. Carbohydrates and fat serve as the main supply of fuel wherewith to maintain bodily heat. A certain temperature is necessary for the functional activities of the animal body. If it falls below or rises above a certain point, death generally ensues. This heat is kept up by the destruction or burning of certain nutrients in the body. If sugar or starch were burned in a stove, they would evolve heat, and would form, among other things, carbonic acid gas. If, instead of being burned, the starch and sugar were eaten, they would be consumed by the vital processes of the animal, the same amount of heat would be formed, and the same chemical compounds would result as in the burning. Combustion would be slower, but the results would be the same.

2. Carbohydrates and fat are burned not only to keep the body warm but to produce the energy used in muscular motion. The analogy of these nutrients and the muscular system to coal and the locomotive is close. Any decided exertion of the body is accompanied by much increase in the expenditure of carbohydrates and fat. The nitrogenous materials suffer but little loss. Of course they are necessary, yet the carbohydrates appear to be most vitally concerned. Fat more than any other one constituent of the body appears to be available for this purpose. It has for this, for the heat producing function, and for fat storage from 2.25 to 2.5 times the value of carbohydrates.

3. If there be an excess of these nutrients eaten over what is required for the production of heat and force, storage as fatty tissue may take place. Either nutrient may be used for this purpose.

4. These nutrients, when digested, serve to protect the more costly protein from over-consumption by the vital processes. As has been pointed out hitherto the several functions of the carbohydrates and fat may be performed by protein. These secondary functions of protein are held in abeyance, however, when the carbohydrates and fat are present in proper quantities.

5. The ultimate source of the fat of milk has been in controversy for years. Protein, food-fat and carbohydrates have all been urged as the causal nutrient. While this point is perhaps not fully settled, Jordan's [1] results go far towards proving that carbohydrates are mainly concerned in the formation of milk-fat, since, in his experiment a cow was fed for three months on a ration containing less than 6 pounds of digestible fat,

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1. N. Y. (State) Sta. Bul. 132 (1898).

yet she gave in her milk 63 pounds of fat. This extra fat could not have come from previously stored bodily fat, since the cow gained 47 pounds in weight, and was judged to be fatter at the end than at the opening of the trial.

4. Digestibility

A chemical analysis of a fodder or feed shows the crude nutrients it contains, but gives no hint as to their availability as food. All food eaten is not digested. Such as is dissolved by the sundry ferments of the digestive tract is assimilated; the residual undigested portion forms the solid excreta or dung. The proportions of the total amount of a crude nutrient which may be digested from a given fodder or feed is influenced by sundry conditions. The kind of animal, its breed, individuality, age and condition as regards work are important. Likewise the quantity of fodder fed, its succulence or dryness, its method of preparation, stage of growth, conditions affecting it like weather or long keeping and the addition of concentrated foods to a ration variously affect results. Among the more important points which have been determined by experiment may be cited the following:

Animal. *Kind.*—Horses digest less fiber and ether extract but nearly or quite as much protein and nitrogen-free extract as do ruminants, (cows, sheep, etc). The latter digest the same kind of food essentially alike. Swine seem to digest the crude fiber of certain feeds better than either horses or ruminants.

Breed and age.—No effects have been determined which may be ascribed to differences in breed or age.

Individuality.—Variations due to this cause are wide, wider oftener than between differing breeds and species.

Rest and work.—Many tests have shown as a rule but slight differences.

Fodder. *Quantity.*—A large number of tests have shown practical uniformity in digestibility regardless of the amount eaten of a given food.

Green or dry.—If cut at the same time and dried without loss of leaves, drying does not affect digestibility. In actual practice, owing to loss of leaves, dried fodders are less digestible than when green.

Method of hay making.—Hay made in the most rapid manner, with the least possible handling, and dried only enough to insure its keeping, loses less of its finer and more digestible portions than when slowly made, much tumbled, exposed to rain, etc.

Preparation.—Moisture, dryness, warmth, or cold affect results but slightly. Cooking avails nothing, but cutting or "chaffing" at times does aid somewhat.

State of growth.—As a rule digestibility lessens as growth advances. The largest yield of digestible nutrients is however more important than extreme digestibility. This is not attained by frequent cuttings of very young

forage plants. Maximum amounts of digestible nutrients are generally obtained when plants are cut in full bloom[1] or shortly after. Earlier cutting gives less yield, while a later cutting results in a lowering in quality greater than the increase in quantity.

Weather.—Wet or dry weather influences different crops on different soils variously, and affects digestibility in sundry ways.

Long keeping.—Many experiments show lessened digestibility as a result of long keeping, due in some measure to loss of leaves and, also, to actual loss of dry matter.

Concentrated food added to coarse fodders—Protein.—A feed rich in easily digestible protein does not affect the digestibility of the coarse fodder.

Concentrated food added to coarse fodders—Fat.—Small quantities of fat seem to increase digestibility. More than ten ounces a day depresses digestibility. If not fed by itself but as oil cake or meal, more than this may be fed without causing such depression.

Concentrated food added to coarse fodders—Carbohydrates.—Additions of starch, sugars, etc., until they amount to 10 per cent or more of the dry substance of a ration depress the digestibility, particularly of the protein and fiber. If nutritive ratios exceed 1:8 some of the carbohydrates are similarly affected.

Roots and potatoes.—If the dry substance of these make up more than 15 per cent of that of the entire ration, digestibility is decreased; otherwise it is not affected. If fed with a nitrogenous concentrate, more than 15 per cent of dry matter can be fed without lessening digestibility.

Grains and byproducts are more digestible than roughages; immature crops than those which are mature; and ground feeds than those which are unground.

DIGESTION COEFFICIENTS

Inasmuch as the rates of digestibility are unequal for the same nutrient in different feeds, and under different conditions and eaten by various kinds of animals, the determination of these rates for each fodder in each condition and for each class of animal is needed. This knowledge is gained by digestion experiments, wherein rations of definite composition are fed in known quantities. After prolonged feeding with the experimental ration has cleared the stomach and intestines of the residues of other rations previously fed, the solid excreta as well as the food are weighed and analyzed for several days. Income and outgo are thus measured. The amount of the undigested crude nutrients passed in the dung subtracted from the total amounts fed gives the amounts digested with a fair degree of accuracy.

Repetition with many animals and under diverse conditions serves to lessen the disturbing effect of individuality and to favor an approximation

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1 Corn is an exception.

to a true average. The proportions digested, expressed as percentages, are termed "digestion coefficients." The conduct of a digestion experiment, although stated thus simply, requires much labor, is open to many errors and difficulties, and the results are sometimes unsatisfactory.

A survey of digestion coefficients shows wide variations in different materials. From 6 to 94 per cent protein, from 29 to 100 per cent nitrogen-free extract, and from 19 to 100 per cent ether extract is found to be digestible in different foods.

DIGESTIBLE NUTRIENTS

The amounts of digestible nutrients in a given ration are determined by multiplying the percentages of crude nutrients by their respective digestion coefficients. The products are the pounds of digestible nutrients in 100 pounds. The calculation of clover hay is given as an example.

	Water	Dry matter	Crude ash	Crude protein	Crude fiber	Nitrogen-free extract	Ether extract
Analysis.........	15.3	84.7	6.2	12.3	24.8	38.1	3.3
Digestion coefficients......		.57		.58	.54	.64	.55
Digestible nutrients.........		48.3		7.1	13.4	24.4	1.8

5. CONCERNING TABLES OF ANALYSES, DIGESTIBLE INGREDIENTS, ETC.

Accompanying this bulletin—as an appendix—pages 37–56—will be found a glossary of definitions of the terms used and tables showing :

Table I. Feeding standards.

Table II. Average composition—both as feed and as fertilizer—of the feeding stuffs most commonly used in New England. (With but few exceptions analyses of samples are from American sources.)

Table III. Digestion coefficients determined by American experiment stations and digestible ingredients of the feeding stuffs in table II.

Table IV. The pounds of total dry matter, of total organic matter and of digestible protein and carbohydrates—with nutritive ratios—in varying weights of fodders and feeds.

This latter table is essentially a convenience table, eliminating from the calculation of a feeding ration all but the final additions and simplifying so far as possible the mathematics needed in figuring a ration.

The data of analyses given in table II as indicated therewith are selected from several sources. They represent the feeding stuffs in use today in this section of the country better than any other set of tables known to the writer. This is particularly true as regards certain concentrated byproducts in large use in New England. Changes in method of manufacture have been such that the analyses of five and ten years ago differ decidedly from those of the goods sold to-day under the same trade names. The

data of analyses have been carefully reviewed; the digestion coefficients used are taken from the most complete and latest compilation of American experiments[1]; the convenience tables have been made so as to meet almost any conceivable need; and all the calculations and figures have been checked and verified.[2] It is felt therefore that these tables are adapted for use in New England feeding practice. Maxima and minima are not included, nor are sundry details as to the stage of growth of certain crops. These are important items, but room for them is lacking. Such readers as desire to note the variations in composition among fodders and feeds of the same kind are referred to tables in Farmers' Bulletin 22 of the United States department of agriculture; and for similar variations in concentrates, to bulletins 78 and 82 of this station.

III. FEEDING STANDARDS

1. THE NATURE OF FEEDING STANDARDS

Study of the sundry functions of the various nutrients shows that the rapidly growing animal, the deep milking cow and the heavy fleeced sheep need a liberal protein supply. It shows that the mature animal, kept without gain or loss, or simply laying on fat, needs relatively less protein, but much carbohydrates. Such study also shows that work consumes carbohydrates and fat, although using up muscle structure which can be built only of protein.

A knowledge of functions, however, furnishes no clue as to the proper proportions of the sundry nutrients for the various purposes for which stock is kept. And the next and obvious step is the determination of these amounts and proportions. How much protein, carbohydrates and fat and how much total food need be fed to the cow, the horse, the sheep or the pig, that each may do its best? What are the bodily needs of a given animal; what food will meet these needs; how much and what nutrients will maintain an animal without gain or loss; and how shall maximum production be attained at minimum expense?

A vast amount of experimental work has been done in Europe and in this country with a view of determining the fundamental laws of nutrition upon which rests the economical practice of stock feeding. While results of great value have been secured, our knowledge of underlying principles is still imperfect, though yearly increasing. Its incomplete condition, however, does not preclude the use of such information as is at hand in the

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1 Jordan & Hall: U. S. Dept. Agr., Of. Exp. Sta., Bul. 77 (1900).

2 Notwithstanding care errors are not unlikely to have crept in unobserved. The writer will esteem it a kindness if any such are pointed out.

formulation of the food requirements of farm animals. Feeding experiments, the careful observation of practice and the study of animal nutrition have all contributed to this end; and, as a result, several "feeding standards" have been proposed. These standards have been classified under three heads as the "physiological standard," the "formula for profit," and the "average feeding ration."[1] They may be termed the physiological, practicable, and the average standards.

1. *Physiological standards.*—These are meant to express the proportions of digestible nutrients best adapted to various animal needs and to the sundry purposes for which stock is kept. A large part of the total nutrients are required for mere maintenance, to keep the animal alive without deterioration. The residue, if any, is applied to production. Much experimental work with stock, mainly bovine, has afforded some notion of the relation between bodily needs and food supply. Yet differences among individuals, breeds and species, as well as fodders and feeds, environments, climates, care, etc., and among feeders, are wide; and, moreover, analytical methods are imperfect. Hence while physiological needs are known, absolute standards based on definite requirements cannot be fixed. They are both irrational and impossible. The use of these standards, then, is hedged about with many limitations which should be clearly apprehended lest these formulas which are extremely helpful if properly used become misleading.

The physiological standards are clearly expressed, easily understood and readily used. On their face, if considered apart from the qualifications, they make stock feeding essentially a branch of applied mathematics. Their very simplicity and directness, however, are their fault, their strength is their weakness, for animal life and nutrition are too complex to be computed by mathematical rule.

The study of the requirements of the individual animal and the adapting of food to its needs is to be preferred to placing the herd, as a whole, upon any inflexible ration. The capacity of an animal to receive, its ability to produce, the effects of the sundry feeds upon the health and condition of the animal, upon its appetite and taste, upon the quality of the product, the money values of feed and the profits to be derived from their use, are important considerations which do not enter into the makeup of the physiological standard but which are vital factors in the feeder's problem. Clearly the physiological standards may supplement and in some measure guide judgment, but cannot take its place.

Under the head of physiological standards, may be listed the original Wolff or "German" standards, the Kuehn standards, the Wolff standards as modified by Lehmann, and those proposed by Atwater and Phelps (Con-

1 Atwater, Conn., (Storrs) Sta. Rpts. 7, pp. 268-221 (1894), 10, pp. 112-119 (1897).

necticut–Storrs-station standards.) It should be said, however, that the latter two standards take cognizance of the amount of the milk flow and its call upon the food supply as a factor in formulation. This important step in advance meets one of the principal objections urged in the past against the old Wolff standard.

2. *Practicable standards—Formulas for profit.*—The "physiological standards" contemplate maximum production only, cost being a secondary consideration. Yet the ration making the most may not be the most profitable. The various factors just mentioned as not entering into the makeup of the physiological standard are vitally important to the farmer; and these factors are variable one year with another, one place with another. Rations which may prove practicable and profitable, as well as fitted to animal needs, in New England may be ill adapted to the conditions in Colorado. Indeed profit may follow quite diverse lines of feeding in the hill towns of Vermont from what would be advisable in the valleys. It may, for instance, pay better in some cases to grow more and to buy less, to feed a relatively wide ration, thus making less product but perhaps more profit.

It is plain that no set "standards" have been or can be formulated to fit such variable circumstances. At times the old Wolff ration, again the Wolff-Lehmann or Storrs standards, or, indeed, often, neither of these may suit certain conditions of feeds and values. Prolonged careful observation of feeding practice and experimentation may throw more light on this phase of the question, but at present it is safe to say that the practicable—because profitable—standard must be worked out for each feeder, each herd, each set of conditions independently, by close study of physiological needs, home and market resources and individual animals.

3. *Average standards—Average feeding rations.*—These are simply the reduction to a mathematical expression of the *average* practice of intelligent feeders, just as averages tell us that the average adult American male is five feet eight inches tall and weighs 155 pounds. "Standards" thus constructed may or may not be wisely used. The writer feels that they are more beneficial as information than as guides, and, it should be remembered, this is all that is claimed for at least one of the so-called "standards." Under this head may be classed the "standards" proposed by the Wisconsin,[1] the Connecticut (Storrs)[2] and the Michigan[3] stations as results respectively of the feeding practice of 128 and 32 herds and of a single herd. The latter case is perhaps hardly to be thus classified and in its place it may be found to be a practicable and profitable standard.

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1 Wis. Sta. Bul. 38 (1894).
2 Conn. (Storrs) Sta. Rpt. 9, pp. 17-66 (1897).
3 Mich. Sta. Bul. 149, pp. 85-96 (1897).

To recapitulate. :

Physiological standards are not absolute rules but average estimates based on experimental work and upon the present knowledge of the physiological needs of farm stock. They are calculated to produce maximum results and omit considerations of cost and other important items. The Wolff, Kuehn, Wolff-Lehmann and Connecticut standards are of this character.

Practicable standards consider the cost of raw material and of product as well as the yield, and are variable. Their use should entail profit. They may be said to be practically "home-made." They are the product of the experience, observation and study of the individual feeder, though they are often decidedly affected by the physiological standards.

Average standards are simply the expression of average feeding practice, apart from all considerations of adaptation to special needs, or ability to produce either large yield or profit. The Wisconsin standard, the Connecticut (32 ration) statement, and, perhaps, the Michigan standard are of this sort.

The remarks thus far made should serve to correct the misconceptions prevalent among feeders as to the true function of feeding standards. They are not rules but guides, not recipes but suggestions, not the mathematical expression of discovered natural laws, but the concisely stated results of practical experience linked with careful observation. They aim to state amounts and proportions of the sundry nutrients advisable under general and average conditions, or to indicate what in other and, often, many hands has done good service without affirming that of necessity such a result will always be attained. These limitations once appreciated, the usefulness of the standards is great. If, however, they are used without a clear understanding of their true character, they may become a stumbling block rather than a stepping stone.

The sundry standards thus far proposed, other than Kuehn's, which have but small vogue, are given in the appendix on pages 40-42. The original Wolff standards were proposed over thirty years ago, but have recently been revised by Lehmann, who has endeavored to make them harmonize with the results of later experiments and experience. The only original Wolff standard given—that for cows—is the one which has had much the largest usage.

2. THE USEFULNESS OF FEEDING STANDARDS

Sundry questions naturally arise in the feeder's mind.

1. Why are the standards stated in terms of nutrients rather than of fodders and feeds?

2. Which of sundry standards for the same animal shall be used?

3. When "doctors disagree" and when "ifs" and "buts" abound may a farmer really find them useful?

4. What happens if standards are disregarded in feeding?

5. How does one go to work to make use of a standard and to formulate a ration?

These questions may be answered as follows:

1. Method of statement.—The standards are expressed in terms of protein, carbohydrates and ether extract instead of hay, corn fodder and bran in order to broaden their application. If stated as so many pounds of hay, silage, corn and cottonseed meals, it would be difficult for the feeder who had oat straw, corn stalks, clover rowen, bran and gluten meal to know how to make up his ration. Now, however, it is a matter of the simplest figuring to construct an approximation to any standard.

2. Choice of standard.—Which standard to choose, for the cow for instance, is not a matter which should be settled dogmatically. Choice should be governed by many conditions which vary from time to time and from place to place, notably those connected with market prices for feeds and product. The feeder's judgment should likewise be an important factor. This has been already pointed out. It is the writer's opinion that given good cows, a good market for the product, not too high prices for concentrated byproducts, and an opportunity to grow fairly abundant supplies of leguminous crops, it will be found as a rule advisable to follow fairly closely the Wolff-Lehmann or the Connecticut formulas.

It should be remarked, however, that in most parts of the United States carbohydrates are abundant and cheap and protein relatively scarce and costly. This condition is reflected in the average feeding practice as shown by the Wisconsin and Connecticut investigations; and, as has been remarked hitherto, conditions may arise which may make the wider ration the more practicable and profitable.

The reasons influencing the writer's opinion—which it may be remarked is in general accord with that of many if not most students of this matter—are that protein more than any other one nutrient seems to be a milk stimulant and to be a measure of milk production; that its reasonably liberal use means a better quality of manure; that the gradation of the food supply, and particularly that of the protein, primarily in accordance with the milk yield, and secondarily according to live weight, instead of solely by the latter, seems sensible; and that with good cows and a good market, a maximum yield, with due regard to health, is usually the cheapest.

3. Are standards of use?—Is it worth while to make choice and use of standards when they are hedged about by so many limitations and when there are so many men of many minds? Emphatically, yes. Standards vary, judgments differ, cows, fodders and feeds are of all sorts and descriptions; yet better results would generally follow the adoption by most feeders of any standard, not only because of the change but because of the closer attention of the owner to his cattle, their care and their feeding. A German

adage says that "the eye of the master fattens his cattle." An old Vermont feeder assured the writer some years ago that his cows did better when he was around where he could "breathe on them."

4. Non-standard feeding—What happens if the feeder follows no standard other than his own sweet will? Perhaps—but very improbably—better results; more likely a poorer outcome. His ration may be suitable to his conditions. It simply does not correspond with those which the experience and judgment of others, the proposers of the sundry standards, have formulated. Departure from standards, if in the direction of lessened food supplies, is apt to result in lowered production, or, in some cases, in shrinkage in bodily weight, or both. If the variation is not in amount, but in the proportion of the sundry nutrients, there is likely to be waste of the ingredient fed in excess, lessened yield or weight, or, sometimes, a produce tion other than the one desired, as, for instance, increase in the flesh rather than in milk yield. If overfeeding is indulged in, if, for instance, too much cottonseed or gluten meals are fed, affording an excess of protein, there may be waste, the health of the animal perhaps may be endangered or the quality of the product impaired.

It has already been pointed out that the physiological standards take no cognizance of economy, their aim being maximum production rather than low cost, the most production rather than the cheapest. Emphasis may again be laid on the fact that the individual feeder must determine for himself whether the greater profit is likely to follow higher production-coupled with greater cost, or lower yield linked with lessened expenditure; whether the use of a home-grown, and, usually, wide ration is wiser than its supplement with purchased protein. It is safe to say, however, that in the long run the weight of evidence favors approximate conformity to standards if maximum yields are desired.

5. Figuring a ration.—How may one formulate a standard ration? What data are necessary and what are the mathematics of the calculation?

The process is simplicity itself mathematically, and is essentially one of "cutting and trying." Given certain roughages and grain feeds, definite weights are provisionally chosen, the pounds and fractions of a pound of total dry matter and digestible nutrients are added, and the result compared with standard. If fairly close, well and good, if choices were wise; if not, addition or subtraction of some one or more may be made with a view of improvement until the end is reached. The whole matter is most clearly explained by example. As has been already remarked, table IV in the appendix greatly simplifies the calculations. This table will be used and the full process will then be explained later (page 22).

3. CALCULATION OF A FEEDING RATION

Let it be assumed for the illustration that a farmer has a cow weighing about 900 pounds and giving about 30 pounds of milk a day, to which he wishes to feed a ration balanced according to the Wolff-Lehmann standard; that he has hay (timothy, Kentucky bluegrass, clover, etc., essentially "mixed grasses"), fairly mature corn silage, bran and cob meal; and that he can buy cottonseed meal, Chicago gluten meal, Quaker dairy feed, mixed (wheat) feed, Buffalo gluten feed and hominy chops. How shall he proceed to figure out his ration? Reference to the standard shows that the 1,000 pound cow should be fed 32 pounds of dry matter, 3.3 pounds protein, 13 pounds carbohydrates and 0.8 pounds ether extract, nutritive ratio, 1:4.5. The ether extract figures are multiplied by 2.25[1] and added to those of the carbohydrates; and then all the figures are multiplied by nine-tenths. This latter is done because a 900 pound cow weighs nine-tenths what a 1,000 pound cow does, and is held, according to the standard, to need approximately but nine-tenths the nutrition. As a matter of fact she probably needs a little more than this.

$0.8 \times 2.25 = 1.8$. $13 + 1.8 = 14.8$. $32.0 \times .9 = 28.8$. $3.3 \times .9 = 2.97$. $14.8 \times .9 = 13.3$.

The Wolff-Lehmann standard for a 900 pound cow giving 30 pounds milk, therefore, requires that the daily food shall contain 28.8 pounds total dry matter, 2.97 pounds digestible protein, 13.3 pounds digestible carbohydrates and ether extract; and, if this is fed, the nutritive ratio will be 1:4.5.

The next step is to supply these nutrients. The convenience table (pages 50–56) shows that of the feeds on hand bran alone has a nutritive ratio (1:3.8) narrower than the standard. The hay, silage and cob meal have "wide" ratios, (1:10.0, 1:14.8, 1:13.9), all wider than the standard. Hence purchases must be made; and these must be of goods with narrow ratios. The materials available are found to have ratios as follows from narrowest to widest: cottonseed meal, 1:1.0; Chicago glüten meal, 1:1.5; Buffalo gluten feed, 1:2.4; mixed (wheat) feed, 1:3.9; Quaker dairy feed, 1:4.6; and hominy chop 1:9.2. It is at once perfectly clear that the latter two feeds will not aid in balancing the ration and that the mixed (wheat) feed will not be of much avail. Hence choice should be made of one or more of the first three according to price and other considerations. Let us assume that the cottonseed and Buffalo goods be chosen and proceed to figure our ration.

It is generally desirable to make as large use of roughages as possible because of their cheapness. The amounts which can be consumed varies with different animals. In dairy feeding, however, more than half and often as much as two-thirds of the total dry matter should be given in the form of roughage.

1 To reduce ether extract to the same food value and —assumedly—feeding value as the carbohydrates.

Let us as a preliminary trial take 10 pounds hay, 25 pounds silage, 4 pounds bran and 1 pound each of cottonseed meal and Buffalo gluten feed. Turning to the "convenience table" we find the total dry matter, digestible protein and carbohydrates, etc., calculated for these weights.

	Dry matter	Digestible protein	Digestible carbohydrates	Nutritive ratio
Hay, 10 pounds	8.5	0.44	4.4	
Silage, 25 pounds	6.6	0.30	4.5	
Bran, 4 pounds	3.5	0.48	1.8	
Cottonseed meal, 1 pound	0.9	0.40	0.4	
Buffalo gluten feed, 1 pound	0.9	0.23	0.6	
Total	20.4	1.85	11.7	1:6.3
Standard	28.8	2.97	13.3	1:4.5

How do they compare? Eight pounds short in total dry matter, one pound short in protein, one and one-half pounds short in carbohydrates; 30 per cent lacking in dry matter, nearly 40 per cent in protein, but only 12 per cent short in carbohydrates. What shall be used to bring the ration up? More roughage will increase carbohydrates faster than protein; more bran will do the same, but not as rapidly; more cottonseed meal will not, and more gluten feed will help more than it will hinder. Inasmuch as it is of doubtful wisdom to feed cottonseed meal very heavily, let us see what the addition of two pounds of cottonseed meal and 1 pound of gluten feed will do.

	Dry matter	Digestible protein	Digestible carbohydrates	Nutritive ratio
Cottonseed meal, 2 pounds	1.8	0.80	0.8	
Buffalo gluten feed, 1 pound	0.9	0.23	0.6	
	2.7	1.03	1.4	
Former result	20.4	1.85	11.7	
New total	23.1	2.88	12.8	1:4.4
Standard	28.8	2.97	13.3	1:4.5

The ration now "balances" yet is still nearly 6 pounds short of total dry matter. Since the ration is a shade narrow rather than wide, one will naturally add now the material with the widest ratio, i. e., silage. But there is a limit to the bulk the animal can handle so that hay may be preferable with some animals. Let us increase the hay two and one-half pounds.

	Dry matter	Digestible protein	Digestible carbohydrates	Nutritive ratio
Hay, 2½ pounds	2.1	0.11	1.1	
Second total	23.1	2.88	12.8	
New total	25.2	2.99	13.9	1:4.6
Standard	28.8	2.97	13.3	1:4.5

The result is still low in total dry matter while giving plenty of nutrients. The ration lacks slightly in bulk but not in food. To try and obtain bulk with fodders on hand would result in feeding more than the standard amounts of the nutrients. Bulk without much nutriment could be furnished by straw, but, as a matter of fact, this is not very important. A ration of 12.5 pounds hay, 25 pounds silage, 4 pounds bran, 3 pounds cottonseed meal and 2 pounds Buffalo gluten meal would meet the Wolff-Lehmann standard requirements for a 900 pound cow with a sufficient approximation to accuracy.

This is a very narrow ration, and, if ever adopted, should be used with caution particularly at the outset. Three pounds of cottonseed meal is heavy feeding, heavier than is often advisable. Were half this replaced with linseed the ration would be the safer and but a trifle poorer in protein.

The longer and complete figuring is carried out as follows: The average analysis of mixed hay, so far as it pertains to the ingredients called for in the determination of the standard, is as follows (Table II): Dry matter 84.7 per cent (100—15.3 per cent water), crude protein 7.4 per cent, crude fiber 27.2 per cent, nitrogen-free extract 42.1 per cent, ether extract 2.5 per cent. The digestion coefficients for these ingredients are respectively (Table III), .59, .60, .59 and .49. Multiplying each percentage by its digestion coefficients gives the digestible ingredients in 100 pounds (Table III), protein, 4.4 ($7.4 \times .59$) crude fiber, 16.3 ($27.2 \times .60$), nitrogen-free extract, 24.8 ($42.1 \times .59$) ether extract, 1.2 ($2.5 \times .49$). Adding the fiber and the nitrogen-free extract and 2.25 times[1] the ether extract for "carbohydrates and ether extract," we get 43.9. Ten pounds of hay being fed, each figure is multiplied by .10 (10 being 1-10 of 100) with results as follows: In 10 pounds mixed hay, total dry matter 8.5 pounds, protein 0.44 pounds, carbohydrates etc., 4.4 pounds. These are the figures given in the top line of the table on page 21, which were read directly from the convenience table, (Table IV) half-way down in the left hand side of page 52. The use of this table obviates this tedious though simple calculation.

4. PLANNING A SEASON'S FEEDING

The farmer who plans his season's feeding ahead is naturally controlled largely by the roughages he has on hand. His cattle are used essentially as means of converting relatively unsaleable farm products into such as will sell. The farm grown roughages will inevitably form the bulk of the diet and the general tendency of feeders is to seek the largest profit from their use rather than to provide a standard ration regardless of cost.

Farm grown roughages and grains are not well adapted to form the sole support of dairy cows. Hence the question arises at the outset whether sales

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1 Ether extract $\times$ 2.25 added. See foot note page 20.

may not be made from the farm and the receipts applied to the purchase of higher grade feeds. May not timothy hay and grain be sold and bran, cottonseed and gluten meals and, perhaps, clover hay be bought without much if any extra outlay, and to the actual improvement of food and manurial supplies? The tables of analyses, digestible ingredients, fertilizing ingredients, etc., in this bulletin, together with a knowledge of market prices and a little figuring will enable any one of experience and judgment in cattle feeding to answer this question for himself and to plan his feeding operations intelligently.

The following suppositious case is worked out at length by way of illustration. It is recommended to the careful consideration of feeders who find it difficult to gain the wherewithal to purchase feed.

A herd of 20 cows, averaging 1,000 pounds weight, are to be fed in the barn from fall to spring, 200 days. The roughages and grain mentioned are available and are assumed to have saleable values in the vicinity as shown.

25 tons timothy hay	$10.00 a ton.
10 " clover hay	7.50 "
80 " silage (mature corn)	3.00 "
300 bushels oats	25 cents[1] a bushel

There are also on the farm seven tons of oat straw, worth, say, $5 a ton, which it is designed to use as bedding, but which may be fed if needed.

The following feeds may be bought in the neighborhood at the prices named:

Corn meal	$16.00 a ton
Wheat bran	17.00 "
Wheat middlings	19.00 "
Mixed (wheat) feed	18.00 "
Cottonseed meal	24.00 "
Linseed meal, new process	26.00 "
Chicago gluten meal	24.00 "
Buffalo gluten feed	20.00 "
Quaker dairy feed	17.00 "

What, if any, sales and purchases may be made in order to winter the herd successfully, and to render more likely a better milk yield at little or no extra outlay and without depleting the plant food supply of the farm?

Twenty cows fed 200 days are equivalent to one cow for 4,000 days. The sundry standards prescribe the following amounts of dry matter and nutrients for 4,000 days; and the hay, silage and oats furnish the amounts shown below:

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1 A low price as oats sell in New England. If, however, a higher figure is assumed the favorable outcome of the scheme is made yet more successful.

	Dry matter	Organic matter	Digestible protein	Digestible carbohydrates[1]	Nutritive ratio
Wolff		96,000	10,000	53,600	1: 5.4
Wolff-Lehmann(medium)	116,000		10,000	56,400	1: 5.6
Wisconsin	98,000		8,600	59,800	1: 7.0
Connecticut (medium)		96,000	11,600	57,600	1: 5.0
Hay, silage and oats	111,000		5,600	65,300	1:11.7

The total dry matter on hand in the hay, silage and oats is about right. There is a moderate excess of carbohydrates, but protein is seriously deficient, and the nutritive ratio excessively wide. Roughages are in excess and grain feed lacking.

It is plain that if sales and purchases be made, feeds rich in carbohydrates should be sold and those rich in protein bought. Timothy hay and oats are readily saleable and have wide nutritive ratios—1:14.3 and 1:6.2—and a pound of digestible dry matter is worth more commercially, or, in other words, costs more—at the assumed prices—than in the clover hay and silage, as is seen in the following showing :

	Price per 100 pounds	Pounds of digestible dry matter	Cost of one pound of digestible dry matter
Timothy hay	$0.50	49.5	1.01 cents.
Clover hay	0.38	48.3	0.78 "
Silage	0.15	18.7	0.80 "
Oats	0.78	62.3	1.25 "

The cottonseed, gluten and linseed meals have narrow nutritive ratios, as has also clover hay, and their digestible dry matter and protein are relatively cheap. It will be wise, therefore, to sell costly dry matter—timothy and oats—and to buy cheaper, and, for cow feeding purposes, better dry matter—cottonseed meal and the like.

Let us assume that a market is found for all the timothy hay and oats. There will have been sold and there will remain on hand dry matter and nutrients as shown herewith :

	Dry matter lbs	Digestible protein lbs	Digestible carbohydrates [1] lbs
Sold : 25 tons timothy hay and 300 bushels of oats	51,900	2,300	28,600
Left on hand : 10 tons clover hay and 80 tons silage	59,100	3,300	36,700

Our feeder has now but little more than half the dry matter needed, but two-thirds the carbohydrates and only one-third the protein. But he has $325 received from the sale of hay and oats to spend in buying feed which is better adapted to his purpose.

1 Ether extract × 2.25 added. See foot note page 20.

The roughages left on hand would admit of feeding 5 pounds clover hay and 40 pounds silage a day to each cow. This is a full-sized silage ration for a 1,000 pound cow. It would be eaten if a minimum of hay were fed. The hay and silage would furnish 15 pounds of dry matter or nearly two-thirds of the total called for by most standards. It is perhaps questionable whether more clover hay and less silage would not be an improvement. The former being found on sale at $7.50, 5 tons are bought and the residue of the silage not used by the cattle in the 200 days of barn-feeding—say 20 tons—are kept for use in summer to help out the pastures.

Our feeder now concludes to adopt the Lehmann standard as a guide and to fit his calculations to the medium standard as being on the whole a fair average for the winter. He has on hand:

	Dry matter	Digestible protein	Digestible carbohydrates
15 tons clover hay	25,400 lbs.	2,100 lbs.	12,600 lbs.
60 tons silage	31,600 "	1,400 "	21,200 "
	57,000 lbs.	3,500 lbs.	33,800 lbs.
This is short of standard for 4,000 days' feeding	59,000 lbs.	6,500 lbs.	22,600 lbs.

He has $287.50 left unexpended. He can feed 7½ pounds of clover hay and 30 pounds silage daily to each cow, giving her thus from 14 to 15 pounds of dry matter in roughages when 29 pounds in all is required.

And now for buying. Study of market prices, costs of a pound of digestible dry matter and of a pound of digestible protein, as shown on pages 34-37, the tables of digestible ingredients, and knowledge of the effects of feeds upon animal and product lead him to choose bran, cottonseed, linseed and gluten meals. Corn meal and the oat feeds are not bought because relatively costly and not adapted to his needs; and, moreover, the silage is from mature corn well eared. Bran is chosen rather than middlings or mixed feed as the wheat offal, not because it is cheaper or as digestible, but because of its good mechanical effect on the ration, its well-recognized milk-making properties and its safety when fed in any amount. Its dry matter and protein are moreover but little more costly than those in the other wheat offals. Cottonseed meal is chosen for use to the limit permisable, being rich in digestible protein, which, moreover, is the cheapest on the market. Linseed meal is a good laxative, has counter effects on animal and product to cottonseed, is pre-eminently healthful, but is comparatively expensive. Gluten meal, at the prices assumed, furnishes perhaps a little cheaper protein but not as cheap dry matter as gluten feed. Either may be chosen.

As a matter of convenience let us fit protein needs first and then note how closely other requirements will be met. 6,500 pounds of digestible protein would be furnished by 27 tons bran, by 8 tons cottonseed meal, by

10 tons linseed or gluten meal, or by 14 tons gluten feed, costing respectively $469, $192, $260, $240 and $280. The amount on hand is $287.50. Clearly the bran purchase should not be large, looking at the matter purely from the side of dollars and cents. Yet the safety of bran already referred to, its good effect in lightening the grain ration is worth a good deal. Let us figure on 3 tons bran, $2\frac{1}{2}$ tons cottonseed, 1 ton linseed, 3 tons gluten meal. These will calculate as follows :

	Digestible protein percentage	Pounds of digestible protein	Cost
6,000 pounds bran	12.	720	$ 51
5,000 " cottonseed meal	40.	2,000	60
2,000 " linseed meal	32.5	650	26
6,000 " gluten meal	32.1	1,930	72
		5,300	$209

There is still a shortage of 1,200 pounds of protein, but there are nearly $80 left. Let us add more bran and linseed meal—for safety and health—and more cottonseed meal.

	Digestible protein percentage	Pounds of digestible protein	Cost
1,000 pounds bran	12.	120	$ 8.50
1,000 " cottonseed meal	40.	400	12.00
2,000 " linseed meal	32.5	650	26.00
		1,170	$ 46.50
Former total		5,300	$209.00
		6,470	$255.50
Left on hand			$ 32.00

The lacking protein is bought and the money is not all spent. A ration of $7\frac{1}{2}$ pounds clover hay, 30 pounds silage and $5\frac{3}{4}$ pounds of these byproducts fed daily will supply the needed protein. It should be remarked however, that were any hay but clover hay fed this would not be the case.

Will this ration furnish the dry matter and carbohydrates needed ?

	Dry matter	Digestible protein	Digestible carbohydrates
7,000 pounds bran	6,200 lbs.	840 lbs.	3,200 lbs.
6,000 " cottonseed meal	5,500 "	2,400 "	2,400 "
4,000 " linseed meal	3,600 "	1,300 "	1,700 "
6,000 " gluten meal	5,300 "	1,920 "	2,800 "
Total	20,600 "	6,460 "	10,100 "
Standard requires in addition to the nutrients on hand in the hay and silage	59,000 lbs.	6,500 lbs.	22,600 lbs.

The protein calculates all right, but dry matter is nearly 20 tons and digestible carbohydrates 6 tons short of what is needed to balance. Casting about for means to meet this condition the farmer finds that his oat straw will be of use. It contains plenty of dry matter, but little digestible protein and plenty of digestible carbohydrates. He finds on reference to the tables that his 7 tons of straw will furnish 12,700 pounds dry matter, 170 pounds of digestible protein, and 6,400 pounds of digestible carbohydrates, leaving the ration still short in dry matter and carbohydrates and narrower than standard. More oat straw, if purchasable, would fit in here. It might bring $5.00 a ton ; 6½ tons may be bought containing 11,800 pounds of dry matter, 160 pounds of digestible protein and 6000 pounds of digestible carbohydrates. This uses up the money and 50 cents in addition.

Now to sum up.

	Dry matter	Digestible protein	Digestible carbohydrates	Nutritive ratio
15 tons clover hay	25,400 lbs.	2,100 lbs.	12,600 lbs.	
60 " silage	31,600 "	1,400 "	21,200 "	
3½ " bran	6,200 "	840 "	3,200 "	
3 " cottonseed meal	5,500 "	2,400 "	2,400 "	
2 " linseed meal	3,600 "	1,300 "	1,700 "	
3 " gluten meal	5,300 "	1,920 "	2,800 "	
13½ " oat straw	24,500 "	330 "	12,400 "	
	102,100 "	10,290 "	56,300 "	1:5.5
Lehmann (medium) standard, 4000 days	116,000 "	10,000 "	56,400 "	1:5.6

The ration would be lacking in bulk but otherwise closely like the standard chosen. The shortage in bulk is not serious. Indeed the Lehmann requirement for dry matter is much in excess of that of any other standard and is somewhat difficult to attain.

The ration as formulated has more protein than is needed by nearly 300 pounds. The question now rises whether so much grain feed is needed. May not less cottonseed, linseed or gluten be bought and some money be saved? One could save the most by lessening the linseed, but it would probably be wiser to shorten on the other two. If 500 pounds each of cottonseed and gluten meals be withdrawn $12.00 will be saved. The protein would be reduced to 9,930 pounds, carbohydrates to 55,900 pounds, total dry matter to 101,200 pounds, while the nutritive ratio would become 1:5.6. The $11.50 ($12.00 less $0.50 excess expenditure on original calculation) should buy sawdust equal or more than equal to the 7 tons oat straw in absorbing value for stable use.

The outcome of the operation, so far as food is concerned, is as follows : Without the outlay of an extra dollar, timothy hay and oats have been exchanged for clover hay, oat straw, bran, cottonseed, linseed and gluten

meals, and a ration well adapted to milk making is obtained in place of one ill fitted to that end. Moreover 20 tons of silage remain on hand as reserve stock for summer feeding. The final ration for 4,000 days and the average ration for a single 1,000 pound cow are as follows:

Fodders and feeds	Four thousand days				One day			
	Weight tons	Dry matter lbs	Digestible protein lbs	Digestible carbohydrates [1] lbs	Weight lbs	Dry matter lbs	Digestible protein lbs	Digestible carbohydrates [1] lbs
Clover hay	15	25,400	2,100	12,600	$7\frac{1}{2}$	6.35	0.53	3.15
Silage	60	31,600	1,400	21,200	30	7.90	0.35	5.30
Oat straw	$13\frac{1}{2}$	24,500	330	12,400	$6\frac{3}{4}$	6.13	0.08	3.10
Bran	$3\frac{1}{2}$	6,200	840	3,200	$1\frac{3}{4}$	1.55	0.21	0.80
Cottonseed meal	$2\frac{3}{4}$	5,000	2,200	2,200	$1\frac{3}{8}$	1.25	0.55	0.55
Linseed meal, N. P.	2	3,600	1,300	1,700	1	0.90	0.33	0.43
Chicago gluten meal	$2\frac{3}{4}$	4,900	1,760	2,600	$1\frac{3}{8}$	1.23	0.44	0.65
		101,200	9,930	55,900		25.31	2.49	13.98
Wolff-Lehmann (medium) standard		116,000	10,000	56,400		29.0	2.5	14.1

How about fertilizing ingredients? Have not the sales of hay and oats seriously depleted the resources of plant food? A trial balance may be struck here between sales and purchases.

	Nitrogen lbs	Phosphoric acid lbs	Potash lbs
Sales. 25 tons timothy hay	470	265	450
$4\frac{1}{5}$ " oats	181	79	60
Total fertilizing ingredients sold	651	344	510
Purchases. 5 tons clover hay	197	38	220
$3\frac{1}{2}$ " bran	172	202	113
$2\frac{3}{4}$ " cottonseed meal	399	158	103
2 " linseed meal	244	73	56
$2\frac{3}{4}$ " gluten meal	321	18	3
Total fertilizing ingredients bought	1333	489	495

The purchases bring onto the farm 682 pounds more nitrogen and 145 pounds more phosphoric acid than the sales remove, and practically replace the potash which is sold. The added manurial value, if rated at market prices for the same ingredients in commercial fertilizers, is worth $101.34. All of this will not become available to future plant growth, but it is clear that from the standpoint of plant food the operation promises success.

The final outcome of the sale of timothy hay and oats and purchase of clover hay and byproducts in this case is *more food*, *more milk*, *more butter*,

[1] Ether extract × 2.25 added. See foot note page 20.

more and better manure, more profit, some outlay of brains, but no outlay of money.

Although this case is suppositious, and not always possible to duplicate, yet results similar in kind if not in degree might be attained on thousands of Vermont farms, to the benefit of both land and occupants.

IV. SUNDRY ECONOMIC CONSIDERATIONS

1. CLASSIFICATION OF ROUGHAGES AND CONCENTRATES

Lindsey[1] has classified the cattle fodders and feeds in more common use in a clear manner, basing the scheme upon the relative proportions of digestible protein and of digestible carbohydrates contained. His classification, somewhat modified and extended, is presented herewith.

ROUGHAGES

1. *Low in digestible protein, high in digestible carbohydrates.*
   Hay, grasses (other than pasture grass), corn silage, fodder and stover, cereal fodders, straws, (45–75 per cent digestible); roots, potatoes, (75–95 per cent digestible).
2. *Medium in digestible protein, high in digestible carbohydrates.*
   Clovers, pasture grass, rowen, oats and peas, barley and peas, legumes in general ; all either green, hayed or ensiled, (50–70 per cent digestible).

CONCENTRATES

1. *Low in digestible protein, medium in digestible carbohydrates.*
   Oat hulls, cottonseed hulls, cottonseed feed, (40–70 per cent digestible.)
2. *Low in digestible protein, high in digestible carbohydrates.*
   Grains (except peas and beans),cob meal, provenders, corn and oat feeds, barley screenings, wheat screenings, hominy chop, starch feed, (70[2]–90 per cent digestible).
3. *Medium in digestible protein and carbohydrates.*
   Quaker and H. O. dairy feeds, wheat and rye brans, dried brewers grains, malt sprouts, (62–80 per cent digestible).
4. *Medium in digestible protein and high in digestible carbohydrates.*
   Wheat middlings, mixed (wheat) feed and red-dog flour, gluten feeds, Atlas meal, pea meal, (70–87 per cent digestible).
5. *High in digestible protein, medium in digestible carbohydrates.*
   Cottonseed, linseed, flax and gluten meals (74–90 per cent digestible.)

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1 Mass. (State) Sta. Bul. 39, pp. 11, 17 (1896).

2 Wheat screenings, 62.

In general it may be said of roughages that while the mainstay of farm crops for cattle feeding must be of class 1, yet class 2 should be grown and used to the limit of profit.

Of concentrates it may be said that class 1 should never be bought; that some in class 2 are well worth growing, but their purchase for feeding cows is of doubtful advisability; that classes 3, 4 and 5 all contain feeds which are often well worth purchasing, and that in general 5 is more desirable than 4 and 4 more so than 3.

2. RATION MAKING

What combinations may be made of roughages and concentrates for the sundry feeding operations of the farm? Their number is legion. They vary with differences in farms, localities, animals, and their appetites; and farm and market supplies vary. It were wise for the feeder who desires information on this point to consult some good book on feeding. As to dairy feeding, however, a few general statements may be made. Nearly or quite two-thirds of the total dry matter of a ration should be given in roughages. Succulent food—silage, pasture feeding, soiling crops, roots—is to be preferred for part of the ration to all dry feed. In making up a grain ration, overfeeding with the highly concentrated feeds should be avoided. Sickness and deteriorated product may, and waste of food surely will, ensue. While phenomenal cows have handled 12 or 15 pounds of cottonseed meal a day, but few cows can safely take more than 3 pounds, and less than this is safer. Err at first by using too little rather than by using too much cottonseed and gluten meals.

In combining roughages and concentrates for the production of balanced rations, much must be left to judgment. In feeding cows from one-fourth to one-third of the coarse fodder may be made up of straw. More than 15 pounds roots daily, if such be fed at all, are inadvisable. Thirty-five pounds of silage daily is usually a maximum. Not more than one-half of the dry matter of the roughage should be of leguminous origin. As a broad and general rule from 1 to 1.7 pounds of digestible protein should be furnished by the roughage, the remainder by the grain.

Protein requirements may be met and in some cases more than met by feeding 6 to 8 pounds daily of a ration containing one part each of any of the concentrates mentioned on the preceding page in classes 2, 4 and 5, or in classes 3, 4 and 5, or in 2 and 5, or one part of any mentioned in class 5 combined with one and one-half parts of any mentioned in class 3. There is much range of choice which will be governed by sundry considerations already mentioned.

3. FERTILIZING VALUE OF FODDERS AND FEEDS

The animal food content of a fodder or feed is the prime consideration in stock feeding. If, however, the latter is considered in its true relationship to the entire farm enterprise, as an integral part thereof and not as a matter by

itself, the plant food content of cattle feed becomes a thing of great importance. This fact, still unrecognized by the generality of western farmers, is thoroughly appreciated in the east and needs no advocacy here. While the general proposition is agreed to, the relationship of the sundry fodders and feeds to the quality of the manure is not so clear to many farmers. An animal voids nothing that it does not eat or drink, and its voidings are of a different quality, so far as plant food is concerned, in proportion to the variations in the food eaten. Rich food makes rich manure and poor food, poor manure. Clover hay, cottonseeds, linseeds, glutens, brans, distillery byproducts, etc., are of distinct value in this respect, while corn meal and the like rank relatively low. Table II in the appendix shows something of the manurial values of various fodders and feeds. It should not be supposed that every particle of the plant food present will of necessity reach the soil. More or less will be of use according to the care or lack of care with which the manure is handled. It is fair to assume, however, that the losses will be proportional regardless of the quality of the manure.

To the farmer who carefully observes the well known methods of preserving manure from fermentation and leaching, this table is of importance. To him who does not try to follow modern methods in this respect it has much less value.

4. SALES AND PURCHASES

What shall the feeder grow, what shall he sell, what shall he buy? To answer this question in all its details would require the writing of a book. A few general rules may be cited, however, leaving their application to the individual feeder.

Sales.—Nitrogen, phosphoric acid and potash are the very essence of real estate. They come from the soil, and their sale in hay, grain, milk, live stock, etc., makes drafts upon the stock of plant food of the farm. If these are not made good by supplies from without, obtained by growing legumes (clover, peas, beans, etc.,) thus fixing in the soil nitrogen from the air, or by judicious choice of food purchased, soil exhaustion will ultimately ensue. Thorough tillage and cultivation will postpone but cannot prevent this ultimate result.

Carbon, hydrogen and oxygen come from the air. No outlay is needed to obtain them, and their sale does not in the least lessen the opportunity to get more. The supply is inexhaustible and free to all. Hence the sale of farm products containing relatively little nitrogen, phosphoric acid and potash and consisting entirely, or nearly so, of carbon, hydrogen and oxygen is advisable. Fat and water are made up entirely of these latter elements. Hence the more fat and water the farmer can sell at a profit the better, as he does not lessen his farm manurial supplies.

It often happens that sales of nitrogen, phosphoric acid and potash, as hay, grain, milk and live stock are desirable and profitable. The effect upon

the farm stock of fertility should be appreciated, however, and effort made to replace the lost plant food through judicious purchases, thorough tillage, growth of legumes, etc.

Growth.—Water, carbohydrates and protein must all be grown. All are needed whether crops are destined for market or for feeding. Choices will vary in accordance with the class of farming.

What summer and what winter roughages are advisable to grow for dairy feeding? And what are not desirable? And why?

This is to some extent a matter of personal jndgment. The writer is quite willing to allow anyone to disagree with him as to what is the best policy.

Summer. Soiling crops.—A succession of soiling crops designed to help out a short or a drying pasture have been proposed. Anything is better than nothing. Of the many soiling crops the writer considers weekly sowings of oats and peas, with a change to barley and peas later in the season best adapted to Vermont conditions. Silage kept in a small surfaced, deep silo is cheaper and quite as desirable. Rowen, clover and the like may be used. Green corn, however, is expensive as compared with silage and less servicable.

Winter.—Hay containing much timothy sells well, and on this account, and because it is less well adapted than other grasses to dairy feeding, it is an expensive feed for cows. Clover hay and early cut hay are better adapted to this purpose. Mature corn well eared, the kernels just glazing, ensiled ears and all, makes the cheapest carbohydrate food on most Vermont farms. It need not be cut, nor hurried in with extra help, but may be put in whole, and as rapidly or as slowly as circumstances may dictate. If corn is stooked or husked the waste of food is more and the cost of handling as a rule greater. The food in the ear is not bettered for dairy purposes by husking and grinding. Immature corn is relatively watery and tends to make poor silage. It may under some circumstances be advisable to sow it very thickly, making essentially a corn hay, but it is doubtful whether this practice is generally wise in this section. Roots are a relatively costly source of food, good, but expensive as compared with silage. Late cut hay, for cows, is not as good as when cut early because more indigestible.

Purchases.—The course to be pursued in buying should be the exact reverse of that in selling. Other things being equal, buy nitrogen, phosphoric acid and potash and not carbon, hydrogen and oxygen. The tables in the appendix will serve to show how ill-adapted as a supplement to farm grown food or manurial resources is corn meal, which is bought by Vermont farmers more largely than any other feeding stuff.

The dairy farmer in this latitude and section of the country can seldom if ever raise protein enough to enable him to feed his cows a balanced

ration, if he has worked his farm as it should be worked in the growing of carbohydrates. This is true even though hay is cut early and clover largely grown. Hence while the farm is worked as a carbohydrate factory, the feed store when resorted to should supply much protein and comparatively small amounts of carbohydrates.

The three reasons on which this statement is based, are as follows :

1. Carbohydrates are grown upon the farm with relative ease but it is difficult to grow enough protein to feed a large number of animals and to balance the ration.

2. The byproducts of several industries are notably rich in protein and are sold at reasonable prices. Hence it is often cheaper to buy this material than to raise it.

3. It is usually in the line of economy to endeavor to grow carbohydrates in as large amounts as possible, and to buy protein in order to supplement this growth, thus properly balancing the ration, provided the class of cows to which the ration is fed are of the proper grade.

Grain feeds.—What concentrates (grain feed) are advisable for dairy feeding and what are undesirable? And why?

Any saleable grain is worthy of consideration for growing. Corn, if husked at all, may well be ground cob and all. Most farm-grown grains are expensive as cow feed if saleable at fair prices. It should be remembered that in buying the sundry byproducts the protein content is the prime consideration, with others important but secondary. The buyer will usually get better service for the same expenditure from the wheat offals and the oil and glucose byproducts (cottonseed, linseeds, glutens) than from corn meal, ready ground "provenders," oat feeds and the several prepared "feeds," which afford relatively expensive protein. In this connection the effects of sundry byproducts on animal and ration should be borne in mind. Cottonseed meal is rich, and if fed in more than moderate amount it may cause indigestion, garget, constipation, etc.; it is death to pigs and tends to harden butter. Linseed is entirely safe, laxative, and softens butter decidedly. Glutens resemble cottonseed in general effects but to a less degree, are safe for pigs, and, if they contain much fat, tend to soften the butter. No rule can be laid down as to the amounts which may be fed with safety. The writer thinks it wise to use two rather than one of these byproducts that ill effects may be more surely neutralized. These feeds should be used sparingly at the outset until the digestive capabilities of the animal are gauged. The wheat offals and distillery byproducts—if dry—are, so far as is known, without effect for ill on animal or product.

5. RELATIVE VALUE OF GRAIN FEEDS AND BYPRODUCTS

A very pertinent question presents itself as to the relative worth of sundry feeds. This inquiry often takes concrete shapes as follows: Is gluten feed cheaper than bran considering the food it contains? Are oats too expensive to feed cows? Can the farmer afford to feed timothy hay to cows when he can get or grow clover hay to replace it at the same price at which the former sells?

Several attempts have been made to place definite money values on feeds, basing these on their nutrient contents. These attempts have not been so successful as might be wished. Mathematical processes have been used, but untrustworthy results obtained. The value of one feeding stuff as compared with another, calculations being based on the nutrients they contain, cannot be stated with any assurance of accuracy. The value of a pound of digestible dry matter in any feed, however, can be readily found at any time. But the usefulness of this calculation is lessened by the fact that many feeds are bought primarily to furnish digestible protein rather than dry matter; hence comparisons based on the latter may be misleading. It has been proposed by some to meet this objection in the following manner: Some definite price is assumed for a pound of digestible carbohydrates and fat; the ton price of the feed is lessened by the assumed valuation of the weight of these nutrients present; and the remainder is assumed to be the money value of a pound of the digestible protein, from which the pound values are readily ascertained. This proposition, while open to criticism, has, likewise, some degree of merit. It is felt, however, that the results of such a calculation have at best but a doubtful value. Yet the demand for some numerical expression of relative values is urgent, and, in order to meet this in some measure, two tables are presented. The first shows for the more common feeds the assumed prices for 100 pounds at ton rates, the pounds of total digestible nutrients[1], and the price per pound of the same. The second shows the first two items given in the first table, and, also, the pounds of average digestible protein, the pounds of average digestible carbohydrates and ether extract,[1] the latter multiplied by one-half cent (an assumed price for carbohydrates, etc.), the price per pound for digestible protein based on the foregoing assumptions; and, finally, it shows the relative standing of the feeds on the hundred basis as to economy, corn being selected as standard for those feeds low and bran for those feeds high in protein, the reasons for their choice being their large use in cattle feeding.

Attention is called in particular to the fact that the whole scheme rests on assumptions, some of which have but little foundation. The ton prices used simply represent in a very general way the prices of recent years in

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1 Ether extract is multiplied by 2.25. See foot note page 20.

New England. There is little if any basis for the half-cent assumption as the valuation for carbohydrates. Two-thirds of a cent, or, indeed, a yet higher figure, might under some circumstances be a better choice. The figures bear no relation to possible profits which may be derived from the use of the feeds. The exact figures, too, have no value. They change as the prices of the various feeds alter. Their *relativity* is their only merit, and, as has been remarked hitherto, it is the writer's opinion that this merit is not large. Their sole and only excuse is that they may afford some general clue as to comparative values, a clue which, for dairy feeding at any rate, may probably be gained quite as well by simply considering protein percentages and market prices.

COST OF A POUND OF DIGESTIBLE DRY MATTER IN SUNDRY FEEDING STUFFS

Feeds	Cost per 100 lbs. $	Total digestible nutrients lbs	Cost per pound for digestible nutrients cts	Feeds	Cost per 100 lbs. $	Total digestible nutrients lbs	Cost per pound for digestible nutrients cts
Corn meal	0.80	79.5	1.01	Mixed (wheat) feed	0.90	64.8	1.39
Cob meal	0.78	71.3	1.09	Cottonseed meal	1.20	80.3	1.50
Oats	0.90	67.0	1.34	Linseed meal O. P.	1.30	77.1	1.69
Provender	0.85	72.3	1.18	" " N. P.	1.30	74.5	1.74
Quaker dairy feed	0.85	60.9	1.40	Flax meal	1.30	75.5	1.72
H. O. dairy feed	1.00	63.7	1.57	Chicago gluten meal	1.20	78.9	1.52
Corn and oat feeds	0.85	70.4	1.21	Cream gluten meal	1.20	81.1	1.48
Hominy chop	0.90	88.8	1.01	King gluten meal	1.20	86.7	1.38
Wheat bran	0.85	57.9	1.47	Buffalo gluten feed	1.00	80.1	1.25
Wheat middlings	0.95	70.6	1.35	Diamond gluten feed	1.00	82.3	1.22

COST OF A POUND OF DIGESTIBLE PROTEIN IN SUNDRY FEEDING STUFFS

FEEDS	Cost per 100 lbs	Total digestible nutrients	Digestible protein	Digestible carbohydrates, etc.	Digestible carbohydrates × one-half cent	Cost per 100 lbs, less the cost of digestible carbohydrates	Valuation per lb. of digestible protein	Relative values
	$	lbs	lbs	lbs	$	$	cts	
Corn meal	0.80	79.5	6.3	73.2	0.37	0.43	6.83	100
Cob meal	0.78	71.3	4.8	66.5	0.33	0.45	9.38	73
Oats	0.90	67.0	9.2	57.8	0.29	0.61	6.63	103
Provender	0.85	72.3	7.7	64.6	0.32	0.53	6.88	99
Quaker dairy feed	0.85	60.9	10.9	50.0	0.25	0.60	5.50	124
H. O. dairy feed	1.00	63.7	14.7	49.0	0.25	0.75	5.10	134
Corn and oat feeds	0.85	70.4	6.6	63.8	0.32	0.53	8.03	85
Hominy chop	0.90	88.8	8.7	80.1	0.40	0.50	5.74	120
Wheat bran	0.85	57.9	12.0	45.9	0.23	0.62	5.18	100
Wheat middlings	0.95	70.6	12.5	58.1	0.29	0.66	5.28	98
Mixed (wheat) feed	0.90	64.8	13.3	51.5	0.26	0.64	4.81	108
Cottonseed meal	1.20	80.3	40.0	40.3	0.20	1.00	2.50	206
Linseed meal (O.P.)	1.30	77.1	30.8	46.3	0.23	1.07	3.48	150
Linseed meal (N. P.)	1.30	74.5	32.4	42.1	0.21	1.09	3.37	153
Flax meal	1.30	75.5	32.1	43 4	0.22	1.08	3.37	153
Chicago gluten meal	1.20	78.9	32.1	46.8	0.23	0.97	3.02	171
Cream gluten meal	1.20	81.1	29.7	51.4	0.26	0.94	3.16	164
King gluten meal	1.20	86.7	29.7	57.0	0.29	0.91	3.07	168
Buffalo gluten feed	1.00	80.1	23.3	56.8	0.28	0.72	3.09	167
Diamond gluten feed	1.00	82.3	20.3	62.0	0.31	0.69	3.40	153

The table on page 35 points out the cheapness, at the assumed prices, of a pound of digestible nutrients in corn meal, cob meal and hominy chop and the considerable cost of the same in oats and oatmeal mill products. Similarly, among the richer feeds, it discriminates against the linseed products. The feeder who wishes digestible dry matter, and who does not want relatively more protein than carbohydrates, may use this table to advantage. He, however, who needs protein more particularly, may be misled if he pins too much faith on this table; but he may find the one on this page more helpful. This shows the costly character of the starchy feeds as sources of protein supply and the relative cheapness of cottonseed meal and the glutens.

It hardly need be pointed out that the buyer of feed can improve upon either of these tables for himself by substituting local values for such feeds as he has under consideration. Thus, for example, if old process linseed meal were sold at $23, the first figure would become 1.15, the sixth 0.92,

(1.15—0.23), the seventh 2.99 (0.92÷30.8×100), and the eighth, 173 (5.18÷2.99×100).

Economies must needs be practiced in these days of close prices, but cheapness, even the cheapest protein, is not the only thing to be considered. The greatest efficiency at the least cost should be the aim; and efficiency is measured by the milk pail, by palatability, by the effect on the product—as for instance in hardening or softening the butter,—by the effect on the health of the animal, and on the manure pile. The successful feeder must study and practice economy, have wide experience in cattle feeding, possess thorough knowledge of the effects of sundry feeds on animal and product, and finally, exercise his judgment as to adaptability of feeds to profit; and if the latter is intelligently applied "the greatest of these" is judgment.

V. APPENDIX

Glossary of terms used in this bulletin

Table I. Feeding standards.

Table II. Average composition—as food and as fertilizer—of American feeding stuffs most commonly used in New England cattle feeding.

Table III. American digestion coefficients and digestible ingredients in American feeding stuffs.

Table IV. Pounds of total dry matter, of total organic matter and of digestible ingredients (protein and carbohydrates—including ether extract ×2.25)—in varying weights of fodders and feeds, being essentially a convenience table.

GLOSSARY OF TERMS USED IN THIS BULLETIN

Albuminoids. One of the nutrients in the protein group; contains nitrogen; is a "flesh former;" the gluten of grains, white of egg, dry lean meat and curd of milk are albuminoids. (See pages 5-6).

Alkaloids. Alkali-like ingredients of certain plants; poisonous or narcotic; not found to any extent in normal fodders and feeds.

Amide. One of the nitrogenous constituents of plants; less valuable than albuminoids; essentially albuminoids in process of transportation and transition. (See page 6).

Analysis. The process whereby the composition or ingredients of a material are determined.

Animal nutrition. See nutrition.

Ash, crude. The mineral matter; the material left after complete burning; composed mainly of potash, soda, lime, magnesia, iron, sulphuric and phosphoric acids. (See page 5).

Byproduct. A secondary product of an industry; for instance, cottonseed meal is a byproduct of the cotton oil industry, and skim milk and buttermilk are byproducts of butter making.

Calorie. (See page 8).

Carbohydrates. Bodies containing definite proportions of carbon, hydrogen and oxygen, the latter two in the proportions in which they exist in water; hence their name carbo (carbon) ,hydrate (water). In fodders and feeds, cellulose (crude fiber or woody fiber) starch, sugars, gums, etc., are carbohydrates.

Carbon. A chemical element ; with the elements of water makes up the larger part of the dry matter of plants and animals ; derived from the air ; diamonds, lampblack and graphite are pure carbon, coal, an impure carbon.

Carbonic acid gas. A gas arising from the combustion of coal or wood.

Cellulose. (See crude fiber).

Chlorophyll. The green coloring matter of plants.

Concentrate (as applied to stock feeding). Grain feed or byproduct.

Convenience table. Table IV in this bulletin which does away with a large part of the figuring needed in calculating rations.

Crude fiber. (See pages 6-7).

Crude nutrient. (See nutrient).

Digestible. Capable of being digested.

Digestion coefficients. (See pages 12-13).

Dry matter. (See page 7).

Energy. Force either in action or latent ; a product of muscle and nerve force, but a result of the assimilation of food.

Ensile (verb) to place a green crop for preservation in a silo.

Ether extract. (See page 6).

Extract matter. (See nitrogen-free extract).

Extractive matter. A stimulative nitrogenous material in flesh ; the main constituent of beef tea, meat extracts, etc. (See page 6).

Fat. A combination of fatty acids with glycerine ; the main part of the ether extract of seeds and grains ; a common constituent of the animal body ; *crude fat* is a synonym for ether extract, which see.

Feeding standard. A numerical expression of the proportion of sundry digestible nutrients best adapted to some specific end, the same being deduced from experiment, or practice, or both. (See pages 14-17).

Ferment. Any substance, organized (alive) or unorganized, capable of producing fermentation, of bringing about chemical changes to an extent quite disproportionate to its mass ; yeast, certain bacteria and pepsin are ferments.

Fodder. A natural combination of nutrients.

Gelatinoids. Animal proteins of a gelatinous nature. (See page 6).

German standard. See Wolff standard.

Gums. Materials of a carbohydrate nature and of a tenaceous character.

Hydrogen. A chemical element, a gas, the lightest known substance ; combined with oxygen it forms water, with oxygen and carbon it forms

carbohydrates and fat, with these and nitrogen, sulphur and phosphorus it forms the many complex organic nitrogenous bodies.

Legumes. Plants bearing seeds in pods, and capable of fixing nitrogen from the air; clovers, peas, beans, vetches, etc.

Nitrates. Combinations of nitric acid with elements like lime, soda, potash, etc.

Nitrogen. An element, an inert gas; the central element, so to speak, of protein; the most costly element in common use in agriculture.

Nitrogen-free extract. (See page 7)

Nitrogenous matter. Substances containing nitrogen. (See page 6.)

Nutrient. "Crude nutrient" is a synonym for total ingredient; for instance, the total ether extract in a fodder is a crude nutrient. "Digestible nutrient" is a synonym for nutrient and indicates solely that portion of the crude nutrient which is digestible. (See page 7).

Nutrition, animal. The process of promoting growth, or repairing or replacing waste in the animal tissues.

Nutritive ratio. (See pages 7-8).

Organic matter. (See page 7).

Oxygen. The most common element in nature, an active gas, a component of water.

Palatability. The quality which makes a material agreeable to the taste. It has no necessary relation to digestibility; a food may be palatable yet indigestible, or digestible but distasteful.

Phosphate of lime. A combination of phosphoric acid and lime; a prominent constituent of bones, ash, etc.

Phosphoric acid. A compound of phosphorus, oxygen and hydrogen, important both as plant and animal food; in the latter case it is usually combined with lime as phosphate of lime.

Physiological standard. One based on knowledge of the functions of the class of animals to be fed.

Potash. A compound of the elements of potassium and oxygen, important as plant food.

Protein, crude. The nitrogen-containing substances of fodders and feeds. (See page 5.)

Ration. An artificial mixture of fodders, or of fodders and feeds.

Roughage. Coarse fodders (hay, corn, fodder, silage, roots, etc.,) as distinguished from grains, etc.

Starch. One of the most common carbohydrates in fodders and feeds, insoluble in water but digestible, being transformed into sugar during digestion.

Sugars. Sweet compounds of vegetable and animal origin; carbohydrates much like starch chemically, but soluble in water.

Total dry matter. (See dry matter).

Wolff and Wolff-Lehmann standards. (See pages 14-17).

TABLE I. FEEDING STANDARDS

(Showing amounts of nutrients for a day's feeding)

Class	Standard	Animal	Live weight	Total dry matter	Digestible nutrients: Protein	Digestible nutrients: Carbohydrates	Digestible nutrients: Fat	Nutritive ratio
			lbs.	lbs.	lbs.	lbs.	lbs.	1 :
Phys.	Wolff	Cow	1,000	†12.4	2.5	12.5	0.4	5.4
	Wolff-Lehmann	*Oxen*						
"	"	At rest in stall	"	18.	0.7	8.	0.1	11.8
"	"	At light work	"	22.	1.4	10.	0.3	7.7
"	"	At medium work	"	25.	2.0	11.5	0.5	6.5
"	"	At heavy work	"	28.	2.8	13.	0.8	5.3
		Fattening cattle						
"	"	First period	"	30.	2.5	15.	0.5	6.5
"	"	Second period	"	30.	3.0	14.5	0.7	5.4
"	"	Third period	"	26.	2.7	15.	0.7	6.2
		Milch cows						
		When yielding daily—						
"	"	11.0 pounds of milk	"	25.	1.6	10.	0.3	6.7
"	"	16.6 pounds of milk	"	27.	2.0	11.	0.4	6.0
"	"	22.0 pounds of milk	"	29.	2.5	13.	0.5	5.7
"	"	27.5 pounds of milk	"	32.	3.3	13.	0.8	4.5
		Sheep						
"	"	Coarse wool	"	20.	1.2	10.5	0.2	9.1
"	"	Fine wool	"	23.	1.5	12.	0.3	8.5
		Breeding ewes						
"	"	With lambs	"	25.	2.9	15.	0.5	5.6
		Fattening sheep						
"	"	First Period	"	30.	3.0	15.	0.5	5.4
"	"	Second period	"	28.	3.5	14.5	0.6	4.5
		Horses						
"	"	Light work	"	20.	1.5	9.5	0.4	7.0
"	"	Medium work	"	24.	2.0	11.	0.6	6.2
"	"	Heavy work	"	26.	2.5	13.3	0.8	6.0
		Brood sows		22.	2.5	15.5	0.4	6.6
		Fattening swine						
"	"	First period	"	36.	4.5	25.	0.7	5.0
"	"	Second period	"	32.	4.0	24.	0.5	6.9
"	"	Third period	"	25.	2.7	18.	0.4	7.3

†Total organic matter.

TABLE I.—FEEDING STANDARDS—*Continued*

(Showing amounts of nutrients for a day's feeding)

Class	Standard	Animal	Live weight	Total dry matter	Digestible nutrients Protein	Carbohydrates	Fat	Nutritive ratio
			lbs.	lbs.	lbs.	lbs.	lbs.	1 :
Phys.	Wolff-Lehman	*Growing cattle* Dairy breeds. Age in months. Av. live wt. per head, lbs.						
"	"	2– 3............150............	1,000	23.	4.0	13.0	2.0	4.5
"	"	3– 6............300............	"	24.	3.0	12.8	1.0	5.1
"	"	6–12............500............	"	27.	2.0	12.5	0.5	6.8
"	"	12–18............700............	"	26.	1.8	12.5	0.4	7.5
"	"	18–24............900............	"	26.	1.5	12.0	0.3	8.5
		Growing cattle Beef breeds.						
"	"	2– 3............160............	"	23.	4.2	13.0	2.0	4.2
"	"	3– 6............330............	"	24.	3.5	12.8	1.5	4.7
"	"	6–12............550............	"	25.	2.5	13.2	0.7	6.0
"	"	12–18............750...........	"	24.	2.0	12.5	0.5	6.8
"	"	18–24............950............	"	24.	1.8	12.0	0.4	7.2
		Growing sheep Wool breeds.						
"	"	4– 6............ 60............	"	25.	3.4	15.4	0.7	5.0
"	"	6– 8............ 75............	"	25.	2.8	13.8	0.6	5.4
"	"	8–11............ 80............	"	23.	2.1	11.5	0.5	6.0
"	"	11–15............ 90............	"	22.	1.8	11.2	0.4	7.0
"	"	15–20............100............	"	22.	1.5	10.8	0.3	7.7
		Growing sheep Mutton breeds.						
"	"	4– 6............ 60............	"	26.	4.4	15.5	0.9	4.0
"	"	6– 8............ 80............	"	26.	3.5	15.0	0.7	4.8
"	"	8–11............100............	"	24.	3.0	14.3	0.5	5.2
"	"	11–15............120............	"	23.	2.2	12.6	0.5	6.3
"	"	15–20............150............	"	22.	2.0	12.0	0.4	6.5
		Growing swine Breeding stock.						
"	"	2– 3............ 50............	"	44.	7.6	28.0	1.0	4.0
"	"	3– 5............100............	"	35.	5.0	23.1	0.8	5.0
"	"	5– 6............120............	"	32.	3.7	21.3	0.4	6.0
"	"	6– 8............200............	"	28.	2.8	18.7	0.3	7.0
"	"	8–12............250......... ..	"	25.	2.1	15.3	0.2	7.5

TABLE I.—FEEDING STANDARDS—*Continued*

(Showing amounts of nutrients for a day's feeding)

Class	Standard	Animal	Live weight	Total dry matter	Digestible nutrients			Nutritive ratio
					Protein	Carbohydrates	Fat	
Phys.	Wolff-Lehman	*Growing fattening swine*	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
“	“	2– 3........... 50...........	1,000	44.	7.6	28.0	1.0	4.0
“	“	3– 5...........100...........	“	35.	5.0	23.1	0.8	5.0
“	“	5– 6...........150...........	“	33.	4.3	22.3	0.6	5.5
“	“	6– 8...........200...........	“	30.	3.6	20.5	0.4	6.0
“	“	9–12...........200...........	“	26.	3.0	18.3	0.3	6.4
“	Conn. (Storrs)	Cow giving 10-20 lbs. milk..	700-950	21.	2.0	11.0	0.4	6.0
“	“	“ “ 20-25 “	“	22.	2.3	11.0	0.5	5.3
“	“	“ “ 25-30 “	“	22.	2.6	11.0	0.5	4.7
“	“	“ “ 30-35 “	“	23.	2.9	12.0	0.6	4.6
“	“	“ “ 35-40 “	“	23.	3.2	12.0	0.6	4.2
“	“	“ “ 10-20 “	950-1100	23.	2.3	13.0	0.5	6.1
“	“	“ “ 20-25 “	“	24.	2.6	13.0	0.6	5.5
“	“	“ “ 25-30 “	“	24.	2.9	13.0	0.6	5.1
“	“	“ “ 30-35 “	“	25.	3.2	14.0	0.7	4.9
“	“	“ “ 35-40 “	“	25.	3.5	14.0	0.7	4.4
Ave.	Wisconsin	Cow (128 herds)	“	24.5	2.15	13.27	0.74	6.9
“	Conn.	“ (32 herds)	1,000	†26.4	1.97	11.57	0.73	7.0
“	Michigan	“ (1 herd)	“	23.6	2.06	12.50	0.89	7.1
“	“	“ (1 herd)	1,400	22.1	1.89	12.23	0.69	7.2
“	“	“ (1 herd) dry cows......		15.2	1.09	8.20	0 49	8.5

TABLE II.—AVERAGE COMPOSITION OF FEEDING STUFFS MOST COMMONLY USED IN NEW ENGLAND CATTLE FEEDING

FODDERS	Number of analyses	Food constituents: Water	Crude ash	Crude protein	Crude fiber	Nitrogen-free extract	Ether extract	Reference number	Fertilizing ingredients: Nitrogen	Phosphoric acid	Potash
Roughages											
Green fodders											
Pasture grass	...	80.0	2.0	3.5	4.0	9.7	0.8	2	0.56	0.23	0.75
Timothy	56	61.6	2.1	3.1	11.8	20.2	1.2	1	0.50	0.26	0.76
Red Top	5	65.3	2.3	2.8	11.0	17.7	0.9	4	0.45	.. ....	.. ...
Kentucky bluegrass (June grass)	18	65.1	2.8	4.1	9.1	17.6	1.3	1	0.66	0.24	1.08
Rowen	4	70.1	2.4	4.5	7.6	13.7	1.7	5	0.72	0.15	0.55
Fodder corn	126	79.3	1.2	1.8	5.0	12.2	0.5	1	0.29	0.15	0.33
Sweet fodder corn	21	79.1	1.3	1.9	4.4	12.8	0.5	1	0.30	.. ...	.. ...
Barley fodder	6	75.2	2.0	3.4	6.5	12.0	0.9	5	0.54	.. ...	.. ...
Oat fodder	5	62.2	2.5	3.4	11.2	19.3	1.4	1	0.54	0.13	0.38
Rye fodder	7	76.6	1.8	2.6	11.6	6.8	0.6	1	0.42	0.15	0.73
Hungarian	14	71.1	1.7	3.1	9.2	14.2	0.7	4	0.50	0.16	0.55
Oats and peas	9	78.7	1.7	3.5	6.0	9.1	1.0	5	0.56	0.12	0.54
Barley and peas	9	79.4	1.8	3.7	5.2	9.1	0.8	5	0.59	.. ...	.. ...
Red clover	43	70.8	2.1	4.4	8.1	13.5	1.1	1	0.70	0.13	0.46
Alsike clover	4	74.8	2.0	3.9	7.4	11.0	0.9	1	0.62	0.11	0.20
Clover rowen	5	75.0	2.1	4.6	6.2	11.0	1.1	5	0.74	.. ...	.. ...
Hays and dry fodders											
Mixed hay	126	15.3	5.5	7.4	27.2	42.1	2.5	4	1.18	0.27	1.55
Timothy	68	13.2	4.4	5.9	29.0	45.0	2.5	1	0.94	0.53	0.90
Red top	9	8.9	5.2	7.9	28.6	47.5	1.9	1	1.26	0.36	1.02
Kentucky bluegrass (June grass)	8	26.1	6.7	6.1	24.1	33.7	3.3	1	0.98	0.40	1.57
Rowen, mixed	23	16.6	6.8	11.6	22.5	39.4	3.1	1,3	1.86	0.43	1.49
Rowen, fine	15	13.1	6.5	14.0	24.4	38.3	3.7	5	2.24	.. ...	.. ...
Corn fodder	35	42.2	2.7	4.5	14.3	34.7	1.6	1	0.72	0.54	0.89
Corn stover	60	40.1	3.4	3.8	19.8	31.8	1.1	1	0.61	0.29	1.40
Oat hay	6	8.9	6.2	7.6	29.3	45.1	2.9	2	1.22	0.50	0.80
Oat and pea hay	8	11.5	6.6	14.8	24.9	38.9	3.3	5	2.37	0.54	2.25
Hungarian	33	16.5	5.6	8.2	22.6	43.9	3.2	5	1.31	0.35	1.30
Red clover hay	38	15.3	6.2	12.3	24.8	38.1	3.3	1	1.97	0.38	2.20
Alsike clover hay	9	9.7	8.3	12.8	25.6	40.7	2.9	1	2.05	0.67	2.23
Clover rowen hay	1	8.3	7.1	13.1	31.3	37.9	2.3	7a	2.10	.. ...	.. ...
Barley straw	97	14.2	5.7	3.5	36.0	39.0	1.5	6	0.56	0.30	2.09
Oat straw	12	9.2	5.1	4.0	37.0	42.4	2.3	1	0.64	0.20	1.24
Wheat straw	7	9.6	4.2	3.4	38.1	43.4	1.3	1	0.54	0.12	0.51
Rye straw	7	7.1	3.2	3.0	38.9	46.6	1.2	1	0.48	0.28	0.79

TABLE II.—AVERAGE COMPOSITION OF FEEDING STUFFS MOST COMMONLY USED IN NEW ENGLAND CATTLE FEEDING

[*Continued*]

FODDERS AND FEEDS	Number of analyses	Food constituents						Reference number	Fertilizing ingredients		
		Water	Crude ash	Crude protein	Crude fiber	Nitrogen-free extract	Ether extract		Nitrogen	Phosphoric acid	Potash
Roughages—*Continued*											
Silages and roots											
Corn silage (mature corn)........	49	73.7	1.6	2.2	6.5	15.1	0.9	8	0.35	0.10	0.40
Corn silage (immature corn) ...	99	79.1	1.4	1.7	6.0	11.0	0.8	1	0.27	0.10	0.40
Corn silage (ears plucked off) ..	6	80.7	1.8	1.8	5.6	9.5	0.6	8	0.29	0.11	0.45
Clover silage	5	72.0	2.6	4.2	8.4	11.6	1.2	1	0.67	.. ...	.. ...
Potatoes..................................	12	78.9	1.0	2.1	0.6	17.3	0.1	1	0.34	0.12	0.46
Beets......	9	88.5	1.0	1.5	0.9	8.0	0.1	1	0.24	0.09	0.44
Sugar beets..............................	19	86.5	0.9	1.8	0.9	9.8	0.1	1	0.29	0.10	0.48
Carrots....................................	8	88.6	1.0	1.1	1.3	7.6	0.4	1	0.18	0.09	0.51
Mangel-wurtzels	9	90.9	1.1	1.4	0.9	5.5	0.2	1	0.22	0.09	0.38
Rutabagas................................	4	88.6	1.2	1.2	1.3	7.5	0.2	1	0.19	0.12	0.49
Turnips	3	90.5	0.8	1.1	1.2	6.2	0.2	1	0.18	0.10	0.39
Miscellaneous											
Apples	3	80.7	0.4	0.7	1.2	16.6	0.4	.....	0.11	0.01	0.19
Apple pomace........................	7	76.7	0.5	1.4	3.9	16.2	1.3	1	0.22	0.02	0.13
Pumpkins	...	90.9	0.5	1.3	1.7	5.2	0.4	2	0.21	0.16	0.09
Skimmilk	7	90.6	0.7	3.1	... ..	5.3	0.3	4	0.50	0.20	0.19
Buttermilk	85	90.1	0.7	4.0	... ..	4.0	1.1	6	0.64	0.17	0.16
Whey	46	93.8	0.4	0.6	... ..	5.1	0.1	6	0.10	0.14	0.18
Concentrates											
Grains and byproducts											
Corn meal................................	77	15.0	1.4	9.2	1.9	68.7	3.8	1	1.47	0.63	0.40
Corn and cob meal	7	15.1	1.5	8.5	6.6	64.8	3.5	1	1.36	0.57	0.47
Oats	30	11.0	3.0	11.8	9.5	59.7	5.0	1	1.89	0.82	0.62
Provender (½ corn, ½ oats)......	...	13.0	2.2	10.5	5.7	64.2	4.4	.....	1.68	0.73	0.51
Provender (as sold in New Eng)	13–38	11.6	2.6	9.3	8.0	64.7	3.8	9,8	1.49	.. ...	.. ...
Oat hulls..	1	7.3	6.7	3.3	29.7	52.1	1.0	2	0.53	.. ...	.. ...
Quaker dairy feed	5–24	8.3	5.0	13.4	16.8	52.8	3.7	9,8	2.14	0.82	0.70
H. O. dairy feed.....................	6–20	8.8	3.8	18.9	13.3	51.2	4.0	9,8	3.02	.. ...	.. ...
Victor corn and oat feed	4–64	9.9	4.0	8.9	12.8	60.6	3.8	9,8	1.42	.. ...	.. ...
H. O. horse feed.....................	9–24	9.9	3.1	12.4	10.1	60.4	4.1	9,8	1.98	.. ...	.. ...
Barley	10	10.9	2.4	12.4	2.7	69.8	1.8	1	1.98	0.79	0.48
Barley screenings...................	2	12.2	3.6	12.3	7.3	61.8	2.8	1	1.97	.. ...	.. ...
Wheat	310	10.5	1.8	11.9	1.8	71.9	2.1	1	1.90	0.80	0.50
Wheat bran	88	11.9	5.8	15.4	9.0	53.9	4.0	1	2.46	2.89	1.61
Wheat middlings....................	32	12.1	3.3	15.6	4.6	60.4	4.0	1	2.50	0.95	0.63

TABLE II. AVERAGE COMPOSITION OF FEEDING STUFFS MOST COMMONLY USED IN NEW ENGLAND CATTLE FEEDING

[*Continued*]

FEEDS	Number of analyses	Food constituents						Reference number	Fertilizing ingredients		
		Water	Crude ash	Crude protein	Crude fiber	Nitrogen-free extract	Ether extract		Nitrogen	Phosphoric acid	Potash
Concentrates—*Continued*											
Grains and byproducts											
Wheat screenings	10	11.6	2.9	12.5	4.9	65.1	3.0	1	2.00	.. ...	.. ...
Mixed (wheat) feed	48	10.8	5.5	16.8	7.4	54.8	4.7	9	2.69	.. ...	.. ...
Reddog flour	1	[illegible].0	3.8	22.2	1.9	57.4	5.7	8	3.55	.. ...	.. ...
Rye	6	11.6	1.9	10.6	1.7	72.5	1.7	1	1.70	0.82	0.54
Rye bran	7	11.6	3.6	14.7	30.5	63.8	2.8	1	2.35	2.28	1.40
Buckwheat	8	12.6	2.0	10.0	8.7	64.5	2.2	1	1.60	0.44	0.21
Buckwheat hulls	2	11.6	2.8	5.6	35.0	43.4	1.6	1	0.90	0.07	0.52
Buckwheat bran	2	10.5	3.0	12.4	31.9	38.8	3.3	2	1.98	0.68	0.75
Buckwheat middlings	6	11.5	4.5	27.5	4.2	45.3	7.0	1,8	4.40	1.95	0.99
Cottonseed meal	10–249	8.3	6.9	45.4	5.5	22.7	11.2	9,8	7.26	2.88	1.87
Cottonseed feed	8	11.7	3.1	12.0	31.0	39.1	3.1	7b	1.92	0.85	1.38
Cottonseed hulls	20	11.1	2.8	4.2	46.3	33.4	2.2	4	0.67	0.25	1.02
Linseed meal (old process)	8–31	9.9	5.8	34.6	8.1	34.1	7.5	9,8	5.54	1.66	1.37
Linseed meal (new process)	4–43	10.7	5.6	38.1	8.2	34.8	2.6	9,8	6.10	1.83	1.39
Flax meal	2	11.4	5.1	37.8	8.8	33.4	3.5	9,8	6.05	1.80	1.31
Gluten meal (Chicago)	5–98	12.3	1.3	36.5	1.4	45.8	2.7	9,8	5.84	0.39	0.06
Gluten meal (Cream)	4–82	10.1	0.8	33.7	1.7	51.1	2.6	9,8	5.39	0.36	0.20
Gluten meal (King)	1–17	7.4	0.5	33.7	1.2	52.6	4.6	9,8	5.39	0.36	0.07
Gluten feed (Buffalo)	6–43	9.6	2.3	27.1	6.7	51.1	3.2	9,8	4.34	0.83	0.43
Gluten feed(Di'm'nd or R'ckf'd)	5–32	8.9	0.8	23.6	6.6	56.6	3.5	9,8	3.78	0.30	0.08
Hominy chop	8–20	8.4	2.6	11.3	4.9	64.9	7.9	9,8	1.81	0.98	0.49
Starch feed, wet	12	65.4	0.3	6.1	3.1	22.0	3.1	1	0.98	.. ...	.. ...
Dried brewers' grains	3	8.2	3.6	19.9	11.0	51.7	5.6	1	3.18	1.03	0.09
Atlas gluten meal	6	8.3	1.8	33.7	11.5	32.1	12.6	3,8	5.39	0.65	0.14
Malt sprouts	4	10.2	5.7	23.2	10.7	48.5	1.7	1	3.71	1.43	1.63
Pea meal	2	10.5	2.6	20.2	14.4	51.1	1.2	1	3.23	0.82	0.99

References (for fodder analyses). Table II.

1. Jenkins and Winton, U. S. Dept. Agr., Of. Exp. Sta., Bul. 11 (1892).

2. Woll, Handbook for Farmers and Dairymen, pp. 3-5 (1900).

3. Lindsey and Crocker, Mass. Hatch. Sta. Rpt., 8, pp. 248-259 (1896).

4. Allen, U. S. Dept. Agr., Farmer's Bul. 22, pp. 24–32 (1895).

5. Atwater and Benedict, Conn. (Storrs) Sta. Rpt. 11, pp. 229-242 (1898).

6. Koenig. Zusam. u. Verdau. d. Futtermittal II, p. 1258.

7. Tenn. Sta. Buls., (a) IV, 1 (1891), (b) IX, 3 (1896).

8. Sundry Vt. Sta. publications more particularly, Bul. 78, Rpts. 6, 8, 9, 10 and 11, and unpublished analyses.

9. Conn. (State) Sta. Rpt. 23, pp. 178-195 (1899).

9.8 The analyses thus marked, with the exception of that of flax meal, are calculated from analyses made within the past two and one-half years by New England stations. In many cases these analyses were simply for protein and fat. These figures have been used in conjunction with those of complete analyses as given in 9 and sundry slight changes have been made in the ash, fiber and nitrogen-free extract figures to correspond with the corrected average protein and ether extract data. Thus for example the cottonseed meal analysis as printed is derived from 10 complete analyses and 249 incomplete ones as is shown in the left hand column. As a result of the use of the latter the average figures for protein, nitrogen-free extract and ether extract of the 10 change respectively as follows: 46.4 becomes 45.4, 22.5 becomes 22.7, and 10.4 becomes 11.2.

TABLE III. AMERICAN DIGESTION COEFFICIENTS; DIGESTIBLE INGREDIENTS OF AMERICAN FEEDING STUFFS

FODDERS	Number of trials	Digestion coefficients						Percentage of digestible ingredients					
		Dry matter	Organic matter	Crude protein	Crude fiber	Nitrogen-free extract	Ether extract	Dry matter	Organic matter	Crude protein	Crude fiber	Nitrogen-free extract	Ether extract
Roughages													
Green fodders													
Pasture grass	1	69	70	66	74	73	55	13.8	12.6	2.3	3.0	7.1	0.4
Timothy	1	64	66	48	56	66	53	24.6	24.0	1.5	6.6	13.3	0.6
Red top	...	[1]						22.2	21.4	1.3	6.2	11.7	0.5
Kent'y blue grass (June grass)	...	[1]						22.3	21.2	2.0	5.1	11.6	0.7
Rowen	2	65	67	70	63	70	54	19.4	18.4	3.2	4.8	9.6	0.9
Fodder corn	14	68	70	60	60	74	74	14.1	13.7	1.1	3.0	9.0	0.4
Sweet fodder corn	6	71	72	64	63	77	76	14.8	14.1	1.2	2.8	9.9	0.4
Barley fodder	2	66	68	72	61	71	60	16.4	15.5	2.4	4.0	8.5	0.5
Oat fodder	3	60	61	72	53	63	69	22.7	21.5	2.4	5.9	12.0	1.0
Rye fodder	1	73	75	79	79	70	75	17.1	16.2	2.1	9.2	4.8	0.5
Hungarian	3	67	69	64	71	68	66	19.4	18.8	2.0	6.5	9.7	0.5
Oats and peas	4	65	67	76	60	68	68	13.8	13.1	2.7	3.6	6.2	0.7
Barley and peas	1	53	60	77	44	61	60	10.9	11.3	2.8	2.3	5.6	0.5
Red clover	1	66	68	67	53	78	65	19.3	18.4	2.9	4.3	10.5	0.7
Alsike clover	...	[2]						16.6	15.8	2.6	3.9	8.6	0.6
Clover rowen	1	59	61	62	53	65	61	14.8	14.0	2.9	3.3	7.2	0.7
Hays and dry fodders													
Mixed hay	5	57	59	59	60	59	49	48.3	46.7	4.4	16.3	24.8	1.2
Timothy	17	57	59	47	53	62	52	49.5	48.6	2.8	15.4	27.9	1.3
Red top	2	60	61	61	61	62	51	54.7	52.4	4.8	17.4	29.5	1.0
Kent'y blue grass (June grass)	...	[3]						44.3	41.0	3.7	14.7	20.9	1.7
Rowen, mixed	2	64	66	69	67	66	47	53.4	50.6	8.0	15.1	26.0	1.5
Rowen, fine	...	[4]						55.6	53.1	9.7	16.3	25.3	1.7
Corn fodder	10	68	71	56	56	72	74	39.3	39.1	2.5	8.0	25.0	1.2
Corn stover	5	57	59	36	64	58	70	34.1	33.3	1.4	12.7	18.4	0.8
Oat hay	1	49	50	54	44	52	62	43.9	41.7	4.1	12.9	23.5	1.8
Oat and pea hay	...	[5]						57.5	54.9	11.2	14.9	26.5	2.2
Hungarian	1	65	66	60	68	67	64	54.3	51.4	4.9	15.4	29.4	2.0
Red clover hay	6	57	60	58	54	64	55	48.3	47.1	7.1	13.4	24.4	1.8
Alsike clover hay	2	62	63	66	54	71	50	56.0	51.7	8.4	13.8	28.9	1.5
Clover rowen hay	2	58	59	65	47	63	60	53.2	49.9	8.5	14.7	23.9	1.4
Barley straw*	5	53	...	20	56	54	42	45.5	42.5	0.7	20.2	21.1	0.6
Oat straw	1	50	52	*30	58	53	38	45.4	44.6	1.2	21.5	22.5	0.9
Wheat straw*	7	43	...	11	52	38	31	38.9	37.1	0.4	19.8	16.5	0.4
Rye straw*	9	46	...	21	60	37	32	42.7	40.4	0.6	23.3	17.2	0.4

1 Assume timothy.
2 Assume red clover.
3 Assume red top.
4 Assume rowen mixed.
5 Assume green oats and peas.
* European coefficients, no American experiments published.

TABLE III. AMERICAN DIGESTION COEFFICIENTS; DIGESTIBLE INGREDIENTS OF AMERICAN FEEDING STUFFS—*Continued*

FODDERS AND FEEDS	Number of trials	Digestion coefficients: Dry matter	Organic matter	Crude protein	Crude fiber	Nitrogen-free extract	Ether extract	Percentage of digestible ingredients: Dry matter	Organic matter	Crude protein	Crude fiber	Nitrogen-free extract	Ether extract
Roughages													
Silages and roots													
Corn silage (mature corn)	10	71	74	56	70	76	82	18.7	18.3	1.2	4.6	11.5	0.7
Corn silage (immature corn)	13	66	67	51	71	67	80	13.8	13.1	0.9	4.3	7.4	0.6
Corn silage (ears plucked off)	...	57	59	36	64	58	70	11.0	10.3	0.6	3.6	5.5	0.4
Clover silage	...	[1]						16.2	15.0	2.7	3.9	7.3	0.7
Potatoes	1	76	77	45	...	90	13	16.0	15.5	0.9	.....	15.6	0.0
Beets	...	[2]						10.9	10.4	1.4	0.9	8.0	0.1
Sugar beets	1	95	99	91	100	100	50	12.8	12.5	1.6	0.9	9.8	0.1
Carrots	...	[3]						10.6	10.0	1.0	1.3	7.4	0.4
Mangel-wurtzels	1	79	85	75	43	91	...	7.2	6.8	1.1	0.4	5.0	...
Rutabagas	1	87	91	80	74	95	84	9.9	9.3	1.0	1.0	7.1	0.2
Turnips	1	93	96	90	100	97	88	8.8	8.4	1.0	1.2	6.0	0.2
Miscellaneous													
Apples	...	[4]						.....	.....	.....	.....	.....	...
Apple pomace	...	[4]						.....	.....	.....	.....	.....	...
Pumpkins	...	[4]						.....	.....	.....	.....	.....	...
Skimmilk* † (separator)	...							9.2	8.5	2.9	.....	5.2	0.3
Buttermilk* †	...	98	...	94	...	98	100	9.7	9.0	3.8	.....	3.9	1.1
Whey*†	...							6.1	5.7	0.6	.....	5.0	0.1
Concentrates													
Grains and byproducts													
Corn meal	5	89	90	68	...	95	92	75.7	75.2	6.3	.....	65.3	3.5
Corn and cob meal	2	79	80	56	46	88	84	67.1	66.7	4.8	3.0	57.0	2.9
Oats*	39	70	...	78	20	76	83	62.3	60.2	9.2	1.9	45.4	4.2
Provender (½ corn, ½ oats)	...	80	...	73	10	86	88	69.6	67.8	7.7	0.6	55.2	3.9
Provender (as sold in New Eng.)	...	[5]						70.7	68.6	6.8	0.8	55.6	3.3
Oat hulls	...	[6]						64.9	60.2	2.6	5.9	39.6	0.8
Quaker dairy feed	1	62	65	81	43	67	89	56.9	56.4	10.9	7.2	35.4	3.3
H. O. dairy feed	1	65	68	78	41	70	86	59.3	59.4	14.7	5.5	35.8	3.4
Victor corn and oat feed	1	75	77	71	48	83	87	67.6	66.3	6.3	6.1	50.3	3.3
H. O. horse feed	1	70	73	74	35	79	84	63.1	63.5	9.2	3.5	47.7	3.4
Barley*	4	86	...	70	50	92	89	76.6	74.6	8.7	1.4	64.2	1.6
Barley screenings	...	[7]					...	75.5	72.4	8.6	3.7	56.9	2.5
Wheat	...	[4]					...	.....	.....	.....	.....	.....	...

1 Assume clover rowen hay.
2 Assume sugar beets.
3 Assume turnips.
4 No basis for assumption.
5 Assume provender.
6 Assume oats
7 Assume barley.
* European coefficients, no American experiments published.
† Digestion coefficients of whole milk.

TABLE III. AMERICAN DIGESTION COEFFICIENTS; DIGESTIBLE INGREDIENTS OF AMERICAN FEEDING STUFFS—*Continued*

FEEDS	Number of trials	Digestion coefficients						Percentage of digestible ingredients					
		Dry matter	Organic matter	Crude protein	Crude fiber	Nitrogen-free extract	Ether extract	Dry matter	Organic matter	Crude protein	Crude fiber	Nitrogen-free extract	Ether extract
Concentrates													
Grains, byproducts, etc.													
Wheat bran	7	62	66	78	29	69	68	54.6	54.3	12.0	2.6	37.2	2.7
Wheat middlings	3	75	79	80	33	81	86	65.9	66.8	12.5	1.5	48.9	3.4
Wheat screenings	...	[1]						54.8	56.4	9.8	1.4	44.9	2.0
Mixed (wheat) feed	...	[2]						61.5	61.1	13.3	2.3	41.1	3.6
Red dog flour	...	[3]						68.3	68.9	17.8	0.6	46.5	4.9
Rye	1	87	89	84	.....	92	64	76.9	77.0	8.9	.....	66.7	1.1
Rye bran	...	[4]						76.9	75.5	12.3	.....	58.7	1.8
Buckwheat	...	[5]						.....	.....	.....	.....	.....	...
Buckwheat hulls	...	[5]						.....	.....	.....	.....	.....	...
Buckwheat bran	...	[5]						.....	.....	.....	.....	.....	...
Buckwheat middlings	...	[5]						.....	.....	.....	.....	.....	...
Cotton seed meal	5	74	76	88	56	61	93	67.9	64.4	40.0	3.1	13.8	10.4
Cotton seed feed	...	[6]						58.3	57.1	7.9	16.1	21.9	2.8
Cotton seed hulls	3	40	41	.....	40	41	86	35.6	35.3	.....	18.5	13.7	1.9
Linseed meal (old process)	1	79	81	89	57	78	89	71.2	68.3	30.8	4.6	26.6	6.7
Linseed meal (new process)	2	79	82	85	80	86	97	70.5	68.6	32.4	6.6	29.9	2.5
Flax meal	...	[7]						70.0	68.5	32.1	7.0	28.7	3.4
Gluten meal (Chicago)	...							78.9	77.8	32.1	.....	41.2	2.5
Gluten meal (Cream)	4	90	90	88	.....	90	94	80.9	80.2	29.7	.....	46.0	2.4
Gluten meal (King)	...							83.3	82.9	29.7	.....	47.3	4.3
Gluten feed (Buffalo)	...							77.7	76.6	23.3	5.2	45.5	2.7
Gluten feed (Diamond or Rockford)	1	86	87	86	78	89	84	78.3	78.6	20.3	5.1	50.4	2.9
	...												
Hominy chop	1	90	93	77	82	95	81	82.4	82.8	8.7	4.0	61.7	6.4
Starch feed, wet	...	[8]						31.1	30.9	5.4	.....	19.8	2.9
Dried brewers grains	1	62	65	79	53	58	91	56.9	57.3	15.7	5.8	30·0	5.1
Atlas gluten meal	1	80	83	73	100	85	91	73.4	74.6	24.6	11.5	27.3	11.5
Malt sprouts	1	67	67	80	33	68	100	60.2	56.3	18.6	3.5	33.0	1.7
Pea meal	1	87	88	83	26	94	55	77.9	76.5	16.8	3.7	48.0	0.7

1 Assume bran.
2 Assume mean of bran and middlings.
3 Assume middlings.
4 Assume rye.
5 No basis for assumption.
6 Assume ¾ meal, ¼ hulls.
7 Assume new process linseed.
8 Assume gluten meal.

TABLE IV.—POUNDS OF TOTAL DRY MATTER, TOTAL ORGANIC MATTER AND DIGESTIBLE INGREDIENTS (protein and carbohydrates [including ether extract × 2.25]) in varying weights of fodders and feeds, being essentially a CONVENIENCE TABLE.

Pounds of fodder	Total dry matter	Organic matter	Protein	Carbohydrates, etc.	Total dry matter	Organic matter	Protein	Carbohydrates, etc.	Total dry matter	Organic matter	Protein	Carbohydrates, etc.
Grasses	Pasture grass, 1:4.8				Timothy grass, 1:14.3				Red top grass, 1:14.6			
2½	0.5	0.5	0.06	0.3	1.0	0.9	0.04	0.5	0.9	0.8	0.03	0.5
5	1.0	0.9	0.12	0.6	1.9	1.8	0.08	1.1	1.7	1.6	0.07	1.0
10	2.0	1.8	0.23	1.1	3.8	3.6	0.15	2.1	3.5	3.2	0.13	1.9
15	3.0	2.7	0.35	1.7	5.8	5.4	0.23	3.2	5.2	4.9	0.20	2.9
20	4.0	3.6	0.46	2.2	7.7	7.3	0.30	4.3	6.9	6.5	0.26	3.8
25	5.0	4.5	0.58	2.8	9.6	9.1	0.38	5.4	8.7	8.1	0.33	4.8
30	6.0	5.4	0.69	3.3	11.5	10.9	0.45	6.4	10.4	9.7	0.39	5.7
35	7.0	6.3	0.81	3.9	13.4	12.7	0.53	7.5	12.1	11.3	0.46	6.7
40	8.0	7.2	0.92	4.4	15.4	14.5	0.60	8.6	13.9	13.0	0.52	7.6
Grasses	Kentucky blue grass, 1:9.2				Green rowen, 1:5.1				Green fodder corn, 1:11.7			
2½	0.9	0.8	0.05	0.5	0.7	0.7	0.08	0.4	0.5	0.5	0.03	0.3
5	1.8	1.6	0.10	0.9	1.5	1.4	0.16	0.8	1.0	1.0	0.06	0.6
10	3.5	3.2	0.20	1.8	3.0	2.8	0.32	1.6	2.1	2.0	0.11	1.3
15	5.2	4.8	0.30	2.7	4.5	4.1	0.48	2.5	3.1	2.9	0.17	1.9
20	7.0	6.4	0.40	3.7	6.0	5.5	0.64	3.3	4.1	3.9	0.22	2.6
25	8.7	8.0	0.50	4.7	7.5	6.9	0.80	4.1	5.2	4.9	0.28	3.2
30	10.5	9.6	0.60	5.5	9.0	8.3	0.96	4.9	6.2	5.9	0.33	3.9
35	12.2	11.2	0.70	6.4	10.5	9.6	1.12	5.7	7.2	6.8	0.39	4.5
40	14.0	12.8	0.80	7.3	12.0	11.0	1.28	6.6	8.3	7.8	0.44	5.2
Green fodders	Sweet fodder corn, 1:11.3				Green barley fodder, 1:5.7				Green oat fodder, 1:8.7			
2½	0.5	0.5	0.03	0.3	0.6	0.6	0.06	0.3	0.9	0.9	0.06	0.5
5	1.0	1.0	0.06	0.7	1.2	1.1	0.12	0.7	1.9	1.8	0.12	1.0
10	2.1	2.0	0.12	1.4	2.5	2.3	0.24	1.4	3.8	3.5	0.24	2.1
15	3.1	2.9	0.18	2.1	3.7	3.4	0.36	2.1	5.7	5.3	0.36	3.1
20	4.2	3.9	0.24	2.7	5.0	4.6	0.48	2.7	7.6	7.1	0.48	4.2
25	5.2	4.9	0.30	3.4	6.2	5.7	0.60	3.4	9.5	8.9	0.60	5.2
30	6.3	5.9	0.36	4.1	7.4	6.8	0.72	4.1	11.3	10.6	0.72	6.2
35	7.3	6.8	0.42	4.8	8.7	8.0	0.84	4.8	13.2	12.3	0.84	7.3
40	8.4	7.8	0.48	5.4	9.9	9.1	0.96	5.4	15.1	14.1	0.96	8.3
Green fodders	Green rye fodder, 1:7.2				Green hungarian, 1:8.7				Oats and peas, 1:4.2			
2½	0.6	0.5	0.05	0.4	0.7	0.7	0.05	0.4	0.5	0.5	0.07	0.3
5	1.2	1.1	0.11	0.7	1.4	1.4	0.10	0.8	1.1	1.0	0.14	0.5
10	2.3	2.2	0.21	1.5	2.9	2.7	0.20	1.7	2.1	2.0	0.27	1.1
15	3.5	3.2	0.32	2.3	4.3	4.0	0.30	2.6	3.2	2.9	0.41	1.7
20	4.7	4.3	0.42	3.0	5.8	5.4	0.40	3.5	4.3	3.9	0.54	2.3
25	5.9	5.4	0.52	3.8	7.2	6.8	0.50	4.3	5.3	4.9	0.68	2.9
30	7.0	6.5	0.63	4.5	8.7	8.2	0.60	5.2	6.4	5.9	0.81	3.4
35	8.2	7.6	0.74	5.3	10.1	9.5	0.70	6.1	7.5	6.8	0.95	4.0
40	9.4	8.6	0.84	6.0	11.6	10.9	0.80	6.9	8.5	7.8	1.08	4.6

TABLE IV.—POUNDS OF TOTAL DRY MATTER, TOTAL ORGANIC MATTER AND DIGESTIBLE INGREDIENTS—*Continued*

Pounds of fodder	Total dry matter	Organic matter	Protein	Carbohydrates, etc.	Total dry matter	Organic matter	Protein	Carbohydrates, etc.	Total dry matter	Organic matter	Protein	Carbohydrates, etc.
Green fodders	Barley and peas, 1:3.2				Red clover (green), 1:5.7				Alsike clover (green), 1:5.3			
2½	0.5	0.5	0.07	0.2	0.7	0.7	0.07	0.4	0.6	0.6	0.07	0.3
5	1.0	0.9	0.14	0.4	1.5	1.4	0.15	0.8	1.3	1.2	0.13	0.7
10	2.1	1.9	0.28	0.9	2.9	2.7	0.29	1.6	2.5	2.3	0.26	1.4
15	3.1	2.8	0.42	1.4	4.4	4.0	0.44	2.5	3.8	3.5	0.39	2.1
20	4.1	3.8	0.56	1.8	5.9	5.4	0.58	3.3	5.0	4.7	0.52	2.8
25	5.2	4.7	0.70	2.3	7.3	6.8	0.73	4.1	6.3	5.9	0.65	3.5
30	6.2	5.6	0.84	2.7	8.8	8.2	0.87	4.9	7.6	7.0	0.78	4.2
35	7.2	6.6	0.98	3.2	10.2	9.5	1.02	5.7	8.8	8.1	0.91	4.9
40	8.2	7.5	1.12	3.6	11.7	10.9	1.16	6.6	10.1	9.3	1.04	5.6
Green fod'rs and silages	Green clover rowen, 1:4.2				Corn silage (mature), 1:14.8				Corn silage (immature), 1:14.6			
2½	0.6	0.6	0.07	0.3	0.7	0.6	0.03	0.4	0.5	0.5	0.02	0.3
5	1.3	1.2	0.14	0.6	1.3	1.2	0.06	0.8	1.0	1.0	0.05	0.6
10	2.5	2.3	0.29	1.2	2.6	2.5	0.12	1.8	2.1	2.0	0.09	1.3
15	3.8	3.5	0.44	1.6	3.9	3.6	0.18	2.7	3.1	2.9	0.14	1.9
20	5.0	4.6	0.58	2.4	5.3	4.9	0.24	3.6	4.2	3.9	0.18	2.6
25	6.3	5.8	0.73	3.0	6.6	6.2	0.30	4.5	5.2	4.9	0.23	3.2
30	7.5	6.9	0.87	3.6	7.9	7.4	0.36	5.3	6.3	5.9	0.27	3.9
35	8.8	8.1	1.02	4.2	9.2	8.7	0.42	6.2	7.3	6.8	0.32	4.5
40	1.00	9.2	1.16	4.8	10.5	9.9	0.48	7.1	8.4	7.8	0.36	5.2
Silages, etc.	Corn stover silage, 1:16.6				Clover silage, 1:4.7				Potatoes, 1:17.3			
2½	0.5	0.4	0.02	0.3	0.7	0.6	0.07	0.3	0.5	0.5	0.02	0.4
5	1.0	0.9	0.03	0.5	1.4	1.3	0.14	0.6	1.1	1.0	0.05	0.8
10	1.9	1.8	0.06	1.0	2.8	2.5	0.27	1.3	2.1	2.0	0.09	1.6
15	2.9	2.6	0.09	1.5	4.2	3.8	0.41	1.9	3.2	3.0	0.14	2.3
20	3.9	3.5	0.12	2.0	5.6	5.1	0.54	2.6	4.2	4.0	0.18	3.1
25	4.8	4.4	0.15	2.5	7.0	6.4	0.68	3.2	5.3	5.0	0.23	3.9
30	5.8	5.3	0.18	3.0	8.4	7.6	0.81	3.9	6.3	6.0	0.27	4.7
35	6.8	6.1	0.21	3.5	9.8	8.9	0.95	4.5	7.4	7.0	0.32	5.4
40	7.7	7.0	0.24	4.0	11.2	10.2	1.08	5.1	8.4	8.0	0.36	6.2
Roots	Beets, 1:6.5				Sugar beets, 1:6 8				Carrots, 1:9.6			
2½	0.3	0.3	0.04	0.2	0.3	0.3	0.04	0.3	0.3	0.3	0.03	0.2
5	0.6	0.5	0.07	0.5	0.7	0.6	0.08	0.5	0.5	0.5	0.05	0.5
10	1.2	1.1	0.14	0.9	1.4	1.3	0.16	1.1	1.1	1.0	0.10	1.0
15	1.7	1.6	0.21	1.4	2.0	1.9	0.24	1.7	1.6	1.6	0.15	1.4
20	2.3	2.1	0.28	1.8	2.7	2.5	0.32	2.2	2.3	2.1	0.20	1.9
25	2.9	2.6	0.35	2.3	3.4	3.1	0.40	2.7	2.9	2.6	0.25	2.4
30	3.5	3.1	0.42	2.7	4.1	3.8	0.48	3.3	3.4	3.1	0.30	2.9
35	4.0	3.7	0.49	3.2	4.7	4.4	0.56	3.8	4.0	3.6	0.35	3.4
40	4.6	4.2	0.56	3.6	5.4	5.0	0.64	4.4	4.6	4.2	0.40	3.8

TABLE IV.—POUNDS OF TOTAL DRY MATTER, TOTAL ORGANIC MATTER AND DIGESTIBLE INGREDIENTS—*Continued*

Pounds of fodder	Total dry matter	Organic matter	Protein	Carbohydrates, etc.	Total dry matter	Organic matter	Protein	Carbohydrates, etc.	Total dry matter	Organic matter	Protein	Carbohydrates, etc.
Roots	Mangel wurtzels, 1:4.9				Rutabagas, 1:8.6				Turnips, 1:7.7			
2½	0.2	0.2	0.03	0.1	0.3	0.2	0.03	0.2	0.2	0.2	0.03	0.2
5	0.4	0.4	0.06	0.3	0.5	0.5	0.05	0.4	0.5	0.4	0.05	0.4
10	0.9	0.8	0.11	0.5	1.1	1.0	0.10	0.9	1.0	0.9	0.10	0.8
15	1.4	1.2	0.17	0.8	1.6	1.5	0.15	1.3	1.4	1.3	0.15	1.2
20	1.8	1.6	0.22	1.1	2.3	2.0	0.20	1.7	1.9	1.7	0.20	1.5
25	2.3	2.0	0.28	1.4	2.9	2.6	0.25	2.2	2.4	2.2	0.25	1.9
30	2.7	2.4	0.33	1.6	3.4	3.1	0.30	2.6	2.9	2.6	0.30	2.3
35	3.2	2.8	0.39	1.9	4.0	3.6	0.35	3.0	3.3	3.0	0.35	2.7
40	3.6	3.2	0.44	2.2	4.6	4.1	0.40	3.4	3.8	3.5	0.40	3.1
Milk	Skim milk, 1:2.0				Butter milk, 1:1.7				Whey, 1:8.7			
2½	0.2	0.2	0.07	0.1	0.2	0.2	0.10	0.2	0.2	0.1	0.02	0.1
5	0.5	0.4	0.15	0.3	0.5	0.5	0.19	0.3	0.3	0.3	0.03	0.3
10	0.9	0.9	0.29	0.6	1.0	0.9	0.38	0.6	0.6	0.6	0.06	0.5
15	1.4	1.3	0.44	0.9	1.5	1.4	0.57	1.0	0.9	0.8	0.09	0.8
20	1.9	1.7	0.58	1.2	2.0	1.8	0.76	1.3	1.2	1.2	0.12	1.0
25	2.4	2.2	0.73	1.6	2.5	2.3	0.95	1.6	1.5	1.5	0.15	1.3
30	2.8	2.6	0.87	1.8	3.0	2.8	1.14	1.9	1.9	1.8	0.18	1.6
35	3.2	3.0	1.02	2.1	3.5	3.3	1.33	3.2	2.2	2.0	0.21	1.8
40	3.7	3.5	1.16	2.4	4.0	3.7	1.52	2.6	2.5	2.3	0.24	2.1
Hays	Mixed hay, 1:10.0				Timothy hay, 1:16.5				Red top hay, 1:10.3			
2½	2.1	2.0	0.11	1.1	2.2	2.1	0.07	1.2	2.3	2.1	0.12	1.2
5	4.2	4.0	0.22	2.2	4.3	4.1	0.14	2.3	4.6	4.3	0.24	2.4
7½	6.4	5.9	0.33	3.3	6.5	6.2	0.21	3.5	6.8	6.4	0.36	3.6
10	8.5	7.9	0.44	4.4	8.7	8.2	0.28	4.6	9.1	8.6	0.48	4.9
12½	10.6	9.9	0.55	5.5	10.9	10.3	0.35	5.8	11.4	10.7	0.60	6.2
15	12.7	11.9	0.66	6.6	13.0	12.4	0.42	6.9	13.9	12.9	0.72	7.4
17½	14.8	13.9	0.77	7.7	15.2	14.4	0.49	8.1	16.0	15.0	0.84	8.6
20	16.9	15.8	0.88	8.8	17.4	16.5	0.56	9.2	18.2	17.2	0.96	9.8
25	21.2	19.8	1.10	11.0	21.7	20.6	0.70	11.6	22.8	21.5	1.20	12.3
Hays	Kentucky blue grass hay, 1:10.6				Rowen hay (mixed), 1:5.6				Rowen hay (fine), 1:4.7			
2½	1.9	1.7	0.09	1.0	2.1	1.9	0.20	1.1	2.2	2.0	0.24	1.1
5	3.7	3.4	0.19	2.0	4.2	3.8	0.40	2.3	4.3	4.0	0.49	2.3
7½	5.6	5.0	0.28	3.0	6.3	5.7	0.60	3.4	6.5	6.0	0.73	3.4
10	7.4	6.7	0.37	3.9	8.3	7.7	0.80	4.5	8.7	8.0	0.97	4.6
12½	9.2	8.4	0.46	4.9	10.4	9.5	1.00	5.6	10.9	10.0	1.21	5.7
15	11.1	10.1	0.56	5.9	12.5	11.4	1.20	6.7	13.0	12.1	1.46	6.8
17½	13.0	11.7	0.65	6.9	14.6	13.4	1.40	7.8	15.2	14.1	1.70	8.0
20	14.8	13.4	0.74	7.9	16.7	15.3	1.60	8.9	17.4	16.1	1.94	9.1
25	18.5	16.8	0.93	9.9	20.9	19.2	2.00	11.2	21.7	20.1	2.43	11.4

TABLE IV.—POUNDS OF TOTAL DRY MATTER, TOTAL ORGANIC MATTER AND DIGESTIBLE INGREDIENTS—*Continued*

Pounds of fodder	Total dry matter	Organic matter	Protein	Carbohydrates, etc.	Total dry matter	Organic matter	Protein	Carbohydrates, etc.	Total dry matter	Organic matter	Protein	Carbohydrates, etc.
Dry fodders	Corn fodder, 1:14.3				Corn stover, 1:23.6				Oat hay, 1:9.9			
2½	1.4	1.4	0.06	0.9	1.5	1.4	0.04	0.8	2.3	2.1	0.10	1.0
5	2.9	2.8	0.13	1.8	3.0	2.8	0.07	1.7	4.6	4.2	0.21	2.0
7½	4.3	4.1	0.19	2.7	4.5	4.2	0.11	2.5	6.8	6.4	0.31	3.0
10	5.8	5.5	0.25	3.6	6.0	5.7	0.14	3.3	9.1	8.5	0.41	4.0
12½	7.2	6.9	0.32	4.5	7.5	8.1	0.18	4.1	11.4	10.6	0.51	5.1
15	8.7	8.3	0.38	5.4	9.0	8.5	0.21	5.0	13.7	12.7	0.62	6.1
17½	10.1	9.6	0.44	6.2	10.5	9.9	0.25	5.8	16.0	14.9	0.72	7.1
20	11.6	11.0	0.50	7.1	12.0	11.3	0.28	6.6	18.2	17.0	0.82	8.1
25	14.5	13.8	0.63	8.9	15.0	14.1	0.35	8.3	22.8	21.2	1.03	10.2
Hays	Oat and pea hay, 1:4.1				Hungarian, 1:10.0				Red clover hay, 1:5.9			
2½	2.2	2.0	0.28	1.2	2.1	1.9	0.12	1.2	2.1	2.0	0.18	1.0
5	4.4	4.1	0.56	2.3	4.2	3.9	0.25	2.4	4.2	3.9	0.36	2.1
7½	6.6	6.1	0.84	3.5	6.3	5.9	0.37	3.6	6.4	5.9	0.53	3.2
10	8.9	8.2	1.12	4.6	8.4	7.8	0.49	4.9	8.5	7.9	0.71	4.2
12½	11.1	10.2	1.40	5.8	10.4	9.7	0.62	6.2	10.6	9.8	0.89	5.2
15	13.3	12.3	1.68	6.9	12.5	11.7	0.74	7.4	12.7	11.8	1.07	6.3
17½	15.5	14.3	1.96	8.1	14.6	13.6	0.86	8.6	14.8	13.7	1.24	7.3
20	17.7	16.4	2.24	9.2	16.7	15.6	0.98	9.8	16.9	15.7	1.42	8.3
25	22.1	20.5	2.80	11.6	20.9	19.5	1.23	12.3	21.2	19.6	1.78	10.5
Hays, etc.	Alsike clover hay, 1:5.5				Clover rowen hay, 1:4.9				Barley straw, 1:61.0			
2½	2.3	2.1	0.21	1.2	2.3	2.1	0.21	1.0	2.1	2.0	0.02	1.1
5	4.5	4.1	0.42	2.3	4.6	4.2	0.43	2.1	4.3	4.0	0.04	2.1
7½	6.8	6.2	0.63	3.5	6.9	6.4	0.64	3.2	6.4	6.0	0.05	3.2
10	9.0	8.2	0.84	4.6	9.2	8.5	0.85	4.2	8.6	8.0	0.07	4.3
12½	11.3	10.3	1.05	5.8	11.5	10.6	1.07	5.2	10.7	10.0	0.09	5.3
15	13.5	12.3	1.26	6.9	13.8	12.7	1.28	6.3	12.9	12.0	0.11	6.4
17½	15.8	14.3	1.47	8.1	16.0	14.8	1.49	7.3	15.0	14.0	0.12	7.5
20	18.1	16.4	1.68	9.2	18.3	16.9	1.70	8.3	17.2	16.0	0.14	8.5
25	22.6	20.5	2.10	11.6	22.9	21.2	2.13	10.5	21.5	20.0	0.18	10.7
Straws	Oat straw, 1:38 3				Wheat straw, 1:93.0				Rye straw, 1:69.0			
2½	2.3	2.1	0.03	1.2	2.3	2.1	0.01	0.9	2.3	2.2	0.02	1.0
5	4.6	4.3	0.06	2.3	4.5	4.3	0.02	1.9	4.6	4.5	0.03	2.1
7½	6.8	6.4	0.09	3.5	6.8	6.4	0.03	2.8	7.0	6.7	0.05	3.1
10	9.1	8.6	0.12	4.6	9.0	8.6	0.04	3.7	9.3	9.0	0.06	4.1
12½	11.4	10.7	0.15	5.8	11.3	10.7	0.05	4.6	11.6	11.2	0.08	5.2
15	13.9	12.9	0.18	6.9	13.5	12.9	0.06	5.6	13.9	13.4	0.09	6.2
17½	16.0	15.0	0.21	8.1	15.8	15.0	0.07	6.5	16.3	15.7	0.11	7.2
20	18.2	17.2	0.24	9.2	18.1	17.2	0.08	7.4	18.6	17.9	0.12	8.3
25	22.7	21.5	0.30	11.5	22.6	21.6	0.10	9.3	23.2	22.4	0.15	10.4

TABLE IV.—POUNDS OF TOTAL DRY MATTER, TOTAL ORGANIC MATTER AND DIGESTIBLE INGREDIENTS—*Continued*

Pounds of feed	Total dry matter	Organic matter	Protein	Carbohydrates, etc.	Total dry matter	Organic matter	Protein	Carbohydrates, etc.	Total dry matter	Organic matter	Protein	Carbohydrates, etc.
Grains	Corn meal, 1:11.3				Corn and cob meal, 1:13.9				Oats, 1:6.2			
¼	0.2	0.2	0.02	0.2	0.2	0.2	0.01	0.2	0.2	0.2	0.02	0.1
½	0.4	0.4	0.03	0.4	0.4	0.4	0.02	0.3	0.4	0.4	0.05	0.3
1	0.9	0.8	0.06	0.7	0.9	0.8	0.05	0.7	0.9	0.9	0.09	0.6
2	1.7	1.7	0.13	1.4	1.7	1.7	0.10	1.3	1.8	1.7	0.18	1.1
3	2.6	2.5	0.19	2.1	2.6	2.5	0.14	2.0	2.7	2.6	0.28	1.7
4	3.4	3.3	0.25	2.9	3.4	3.3	0.19	2.7	3.6	3.4	0.37	2.3
5	4.3	4.2	0.32	3.6	4.3	4.2	0.24	3.4	4.5	4.3	0.46	2.8
7½	6.4	6.3	0.48	5.4	6.4	6.3	0.36	5.1	6.7	6.5	0.69	4.3
10	8.5	8.4	0.63	7.1	8.5	8.4	0.48	6.7	8.9	8.6	0.92	5.7
Grains, etc.	Provender, (½ ½) 1:8.4				Provender (as sold in New England), 1:9 4				Oat hulls, 1:18.2			
¼	0.2	0.2	0.02	0.2	0.2	0.2	0.02	0.2	0.2	0.2	0.01	0.1
½	0.4	0.4	0.04	0.3	0.4	0.4	0.03	0.3	0.5	0.4	0.02	0.3
1	0.9	0.9	0.08	0.6	0.9	0.9	0.07	0.6	0.9	0.9	0.03	0.5
2	1.7	1.7	0.15	1.3	1.8	1.7	0.14	1.3	1.9	1.7	0.05	0.9
3	2.6	2.6	0.23	1.9	2.7	2.6	0.20	1.9	2.8	2.6	0.08	1.4
4	3.5	3.4	0.31	2.6	3.5	3.4	0.27	2.5	3.7	3.4	0.10	1.9
5	4.4	4.3	0.39	3.2	4.4	4.3	0.34	3.2	4.6	4.3	0.13	2.4
7½	6.5	6.4	0.58	4.9	6.6	6.5	0.51	4.8	7.0	6.5	0.20	3.5
10	8.7	8.5	0.77	6.5	8.8	8.6	0.68	6.4	9.3	8.6	0.26	4.7
Byproducts	Quaker dairy feed, 1:4.6				H. O. dairy feed, 1:3.3				Victor corn and oat feed, 1:10.1			
¼	0.2	0.2	0.03	0.1	0.2	0.2	0.04	0.1	0.2	0.2	0.02	0.2
½	0.5	0.4	0.05	0.3	0.5	0.4	0.07	0.2	0.5	0.4	0.03	0.3
1	0.9	0.9	0.11	0.5	0.9	0.9	0.15	0.5	0.9	0.9	0.06	0.6
2	1.8	1.7	0.22	1.0	1.8	1.7	0.29	1.0	1.8	1.7	0.13	1.3
3	2.8	2.6	0.33	1.5	2.7	2.6	0.44	1.5	2.7	2.6	0.19	1.9
4	3.7	3.5	0.44	2.0	3.6	3.5	0.59	2.0	3.6	3.4	0.25	2.5
5	4.6	4.4	0.55	2.5	4.6	4.4	0.74	2.5	4.5	4.3	0.32	3.2
7½	6.9	6.5	0.82	3.8	6.8	6.5	1.10	3.7	6.8	6.5	0.47	4.8
10	9.2	8.7	1.09	5.0	9.1	8.7	1.47	4.9	9.0	8.6	0.63	6.4
Byprod., etc.	H. O. horse feed, 1:6.4				Barley, 1:8.0				Barley screenings, 1:7.7			
¼	0.2	0.2	0.02	0.1	0.2	0.2	0.02	0.2	0.2	0.2	0.02	0.2
½	0.5	0.4	0.05	0.3	0.4	0.4	0.04	0.3	0.4	0.4	0.04	0.3
1	0.9	0.9	0.09	0.6	0.9	0.9	0.09	0.7	0.9	0.8	0.09	0.7
2	1.8	1.7	0.18	1.2	1.8	1.7	0.17	1.4	1.8	1.7	0.17	1.3
3	2.7	2.6	0.28	1.8	2.7	2.6	0.26	2.1	2.6	2.5	0.26	2.0
4	3.6	3.5	0.37	2.4	3.6	3.5	0.35	2.8	3.5	3.4	0.34	2.7
5	4.5	4.4	0.46	2.9	4.5	4.4	0.44	3.5	4.4	4.2	0.43	3.3
7½	6.8	6.5	0.69	4.4	6.7	6.5	0.65	5.2	6.6	6.3	0.65	5.0
10	9.0	8.7	0.92	5.9	8.9	8.7	0.87	6.9	8.8	8.4	0.86	6.6

TABLE IV.—POUNDS OF TOTAL DRY MATTER, TOTAL ORGANIC MATTER AND DIGESTIBLE INGREDIENTS—*Continued*

Pounds of feed	Total dry matter	Organic matter	Protein	Carbohydrates, etc.	Total dry matter	Organic matter	Protein	Carbohydrates, etc.	Total dry matter	Organic matter	Protein	Carbohydrates, etc.
Byproducts	Wheat bran, 1:3.8				Wheat middlings, 1:4.6				Wheat screenings, 1:5.2			
¼	0.2	0.2	0.03	0.1	0.2	0.2	0.03	0.1	0.2	0.2	0.02	0.1
½	0.4	0.4	0.06	0.2	0.4	0.4	0.06	0.3	0.4	0.4	0.05	0.2
1	0.9	0.8	0.12	0.5	0.9	0.9	0.13	0.6	0.9	0.9	0.10	0.5
2	1.8	1.6	0.24	1.0	1.8	1.7	0.25	1.2	1.8	1.7	0.20	1.0
3	2.6	2.5	0.36	1.4	2.6	2.6	0.38	1.7	2.7	2.6	0.29	1.5
4	3.5	3.3	0.48	1.8	3.5	3.4	0.50	2.3	3.5	3.4	0.39	2.0
5	4.4	4.1	0.60	2.3	4.4	4.3	0.63	2.9	4.4	4.3	0.49	2.5
7½	6.6	6.2	0.90	3.4	6.6	6.4	0.94	4.4	6.6	6.5	0.74	3.8
10	8.8	8.2	1.20	4.6	8.8	8.5	1.25	5.8	8.8	8.6	0.98	5.1
Byprod.,etc.	Mixed (wheat) feed, 1:3.9				Red-dog flour, 1:3.3				Rye, 1:7.8			
¼	0.2	0.2	0.03	0.1	0.2	0.2	0.04	0.1	0.2	0.2	0.02	0.2
½	0.4	0.4	0.07	0.3	0.5	0.4	0.09	0.3	0.4	0.4	0.04	0.3
1	0.9	0.8	0.13	0.5	0.9	0.9	0.18	0.6	0.9	0.9	0.09	0.7
2	1.8	1.7	0.27	1.0	1.8	1.7	0.36	1.2	1.8	1.7	0.18	1.4
3	2.7	2.5	0.40	1.5	2.7	2.6	0.53	1.7	2.7	2.6	0.27	2.1
4	3.6	3.3	0.53	2.1	3.6	3.5	0.71	2.3	3.5	3.5	0.36	2.8
5	4.5	4.3	0.67	2.6	4.6	4.4	0.89	2.9	4.4	4.4	0.46	3.5
7½	6.7	6.3	1.00	3.8	6.8	6.5	1.34	4.4	6.6	6.5	0.67	5.2
10	8.9	8.4	1.33	5.2	9.1	8.7	1.78	5.8	8.8	8.7	0.89	6.9
Byproducts	Rye bran, 1:5.1				Cottonseed meal, 1:1.0				Cottonseed feed, 1:5.6			
¼	0.2	0.2	0.03	0.2	0.2	0.2	0.10	0.1	0.2	0.2	0.02	0.1
½	0.4	0.4	0.06	0.3	0.5	0.4	0.20	0.2	0.4	0.4	0.04	0.2
1	0.9	0.9	0.12	0.6	0.9	0.9	0.40	0.4	0.9	0.9	0.08	0.4
2	1.8	1.7	0.25	1.3	1.8	1.7	0.80	0.8	1.8	1.1	0.16	0.9
3	2.7	2.6	0.37	1.9	2.8	2.6	1.20	1.2	2.7	2.6	0.24	1.3
4	3.5	3.4	0.49	2.5	3.7	3.4	1.60	1.6	3.5	3.4	0.32	1.8
5	4.4	4.3	0.62	3.1	4.6	4.3	2.00	2.0	4.4	4.3	0.40	2.2
7½	6.6	6.4	0.92	4.7	6.9	6.4	3.00	3.0	6.6	6.4	0.59	3.3
10	8.8	8.5	1.23	6.3	9.2	8.5	4.00	4.0	8.8	8.5	0.79	4.4
Byproducts	Cottonseed hulls, ——				Linseed meal (O. P.), 1:1.5				Linseed meal (N. P.), 1:1.3			
¼	0.2	0.2	......	0.1	0.2	0.2	0.08	0.1	0.2	0.2	0.08	0.1
½	0.4	0.4	......	0.2	0.5	0.4	0.15	0.2	0.4	0.4	0.16	0.2
1	0.9	0.9	......	0.4	0.9	0.8	0.31	0.5	0.9	0.8	0.32	0.4
2	1.8	1.7	......	0.7	1.8	1.7	0.62	1.0	1.8	1.7	0.65	0.8
3	2.7	2.6	......	1.1	2.7	2.5	0.92	1.4	2.7	2.5	0.97	1.3
4	3.6	3.4	......	1.5	3.6	3.4	1.23	1.8	3.6	3.4	1.30	1.7
5	4.5	4.3	......	1.8	4.9	4.2	1.54	2.3	4.5	4.2	1.62	2.1
7½	6.7	6.5	......	2.7	6.8	6.3	2.31	3.4	6.7	6.3	2.43	3.2
10	8.9	8.6	......	3.7	9.0	8.4	3.08	4.6	8.9	8.4	3.24	4.2

TABLE IV.—POUNDS OF TOTAL DRY MATTER, TOTAL ORGANIC MATTER AND DIGESTIBLE INGREDIENTS—*Continued.*

Pounds of feed	Total dry matter	Organic matter	Protein	Carbohydrates, etc.	Total dry matter	Organic matter	Protein	Carbohydrates, etc.	Total dry matter	Organic matter	Protein	Carbohydrates, etc.
Byproducts	Flax meal, 1:1.4				Gluten meal (Chicago) 1:1.5				Gluten meal (Cream) 1:1.7			
¼	0.2	0.2	0.08	0.1	0.2	0.2	0.08	0.1	0.2	0.2	0.07	0.1
½	0.4	0.4	0.16	0.2	0.4	0.4	0.16	0.2	0.4	0.4	0.15	0.2
1	0.9	0.8	0.32	0.4	0.9	0.9	0.32	0.5	0.9	0.9	0.30	0.5
2	1.8	1.7	0.64	0.9	1.8	1.7	0.64	0.9	1.8	1.8	0.59	1.0
3	2.7	2.5	0.96	1.3	2.6	2.6	0.96	1.4	2.7	2.7	0.89	1.5
4	3.6	3.4	1.28	1.7	3.5	3.4	1.28	1.9	3.6	3.6	1.19	2.1
5	4.5	4.2	1.60	2.2	4.4	4.3	1.60	2.3	4.5	4.5	1.49	2.6
7½	6.7	6.3	2.40	3.3	6.6	6.5	2.40	3.5	6.7	6.7	2.23	3.9
10	8.9	8.4	3.21	4.3	8.8	8.6	3.21	4.7	9.0	8.9	2.97	5.1
Byproducts	Gluten meal (King) 1:1.9				Gluten feed (Buffalo or Marshalltown) 1:2.4				Gluten feed (Diamond or Rockford) 1:3.0			
¼	0.2	0.2	0.07	0.1	0.2	0.2	0.06	0.1	0.2	0.2	0.05	0.2
½	0.5	0.5	0.15	0.3	0.4	0.4	0.12	0.3	0.5	0.4	0.10	0.3
1	0.9	0.9	0.30	0.6	0.9	0.9	0.23	0.6	0.9	0.9	0.20	0.6
2	1.9	1.7	0.59	1.1	1.8	1.8	0.47	1.1	1.8	1.8	0.41	1.2
3	2.8	1.8	0.89	1.7	2.7	2.6	0.70	1.7	2.7	2.7	0.61	1.9
4	3.7	3.7	1.19	2.3	3.6	3.5	0.93	2.3	3.6	3.6	0.81	2.5
5	4.6	4.6	1.49	2.8	4.5	4.4	1.17	2.8	4.6	4.5	1.02	3.1
7½	6.9	6.9	2.23	4.3	6.8	6.6	1.75	4.3	6.8	6.8	1.52	4.7
10	9.3	9.2	2.97	5.7	9.0	8.8	2.33	5.7	9.1	9.0	2.03	6.2
Byproducts	Hominy chop, 1:9.2				Starch feed, wet, 1:4.9				Dried brewers grains, 1:3.0			
¼	0.2	0.2	0.02	0.2	0.1	0.1	0.01	0.1	0.2	0.2	0.04	0.1
½	0.5	0.4	0.04	0.4	0.2	0.2	0.03	0.2	0.5	0.4	0.08	0.3
1	0.9	0.9	0.09	0.8	0.3	0.3	0.05	0.3	0.9	0.9	0.16	0.5
2	1.8	1.8	0.17	1.6	0.7	0.6	0.11	0.5	1.8	1.8	0.31	0.9
3	2.8	2.7	0.26	2.4	1.0	1.0	0.16	0.8	2.8	2.6	0.47	1.4
4	3.7	3.6	0.35	3.2	1.4	1.4	0.22	1.1	3.7	3.5	0.63	1.9
5	4.6	4.5	0.44	4.0	1.7	1.7	0.27	1.3	4.6	4.4	0.79	2.4
7½	6.9	6.7	0.65	6.0	2.6	2.6	0.41	1.7	6.9	6.6	1.18	3.5
10	9.2	8.9	0.87	8.0	3.5	3.4	0.54	2.6	9.2	8.8	1.57	4.7
Byproducts	Atlas gluten meal, 1:2.6				Malt sprouts, 1:2.2				Pea meal, 1:3.2			
¼	0.2	0.2	0.06	0.2	0.2	0.2	0.05	0.1	0.2	0.2	0.04	0.1
½	0.5	0.4	0.12	0.3	0.4	0.4	0.09	0.2	0.4	0.4	0.08	0.3
1	0.9	0.9	0.25	0.6	0.9	0.8	0.19	0.4	0.9	0.9	0.17	0.5
2	1.8	1.8	0.49	1.3	1.8	1.7	0.37	0.8	1.8	1.7	0.33	1.1
3	2.8	2.7	0.74	1.9	2.7	2.5	0.56	1.2	2.7	2.6	0.50	1.6
4	3.7	3.6	0.98	2.6	3.6	3.3	0.74	1.6	3.6	3.5	0.67	2.1
5	4.6	4.5	1.23	3.2	4.5	4.2	0.93	2.0	4.5	4.4	0.84	2.7
7½	6.9	6.7	1.85	4.9	6.7	6.3	1.40	3.0	6.7	6.5	1.26	4.0
10	9.2	9.0	2.46	6.5	9.0	8.4	1.86	4.0	9.0	8.7	1.68	5.3

FLORA OF VERMONT

A LIST OF THE

FERN AND SEED PLANTS

GROWING WITHOUT CULTIVATION.

PREPARED BY

EZRA BRAINERD, L. R. JONES and W. W. EGGLESTON,

COMMITTEE FOR THE

VERMONT BOTANICAL CLUB.

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FLORA OF VERMONT

PREFACE

It is now twelve years since the last edition of Professor Perkins' Flora of Vermont was published. The supply of the Tenth Report of the State Board of Agriculture, which contained that publication, has for some time been exhausted so that it is increasingly difficult to secure copies of it. Moreover these twelve years have included a period of intense activity in systematic botany in the Eastern States, and they have witnessed considerable additions to the knowledge of Vermont plants. The Vermont Botanical Club was organized five years ago for the chief purpose of adding to and recording this knowledge. The present catalogue has been prepared by a committee acting for the Club, and it aims to set forth briefly the facts as at present known to Vermont botanists regarding the occurrence and distribution of the higher plants in the state. It is unnecessary to say that the list is provisional and incomplete. Students of the Vermont Flora will doubtless make yearly additions and corrections to this catalogue, until the time once more arrives when a new one will be necessary. The present list stands merely as a report of progress, and the most that is hoped is that it will prove a stimulus and aid to further advancement.

The list is intended to include the names of all of the seed and fern plants known to occur as native or apart from cultivation within the state. Much pains has been taken to verify doubtful specimens. Where no other authority is given for the determination of the species or its insertion in the list, the plants have been personally examined by this committee. In every case where a name is admitted to the main list there is an authenticated specimen deposited in one or more of the permanent herbaria of the state, or in such other herbarium as is indicated in the accompanying note. The invariable rule has been to admit no name which has not an extant specimen back of it. This has necessarily led to the exclusion of a number of names of plants reported by earlier botanists. In many of these cases the evidence is such as to leave little doubt that the plants actually occurred as reported, and probably many of them will be rediscovered. The names of such plants are included in a supplementary list at the end of the main catalogue, and each name so appearing should be considered as a challenge to the sagacity of present botanists until the plant is again

found. It has not been practicable, however, nor has it seemed important, that the committee examine specimens from all the localities cited in the list. Thus if the specimens from one locality have been verified and the species is therefore admitted to the list, other stations are often cited upon the authority of the collectors alone. But even in such cases, where there was any reason for questioning the identity of the plant, its inspection by recognized authorities has been secured. Stations cited on the sole authority of older published lists are in quotation marks.

These are busy times for the botanist who would keep informed in matters of nomenclature. The committee had some appreciation of this fact when undertaking its task, but this appreciation has increased during the progress of the work. The aim has been, in accordance with the wish of the Vermont Botanical Club, to follow a conservative policy in matters of nomenclature. In all cases, unless otherwise stated, the preferred name is that in accord with the usages of the Kew herbarium, which means in general the usage of the Gray Manual and the Synoptical Flora of North America. Where the name established by the rules of the Botanical Club of the American Association for the Advancement of Science, as expressed in the Britton-Brown Illustrated Flora, is at variance with this preferred name, it follows in parenthesis. All such synonymous names are included in the index.

In the sequence of families the order is that of Engler and Prantl as embodied in the Britton-Brown Illustrated Flora. This is accepted by botanists generally as representing more nearly the natural relationship of plants than does that of any of the older systems. It is believed that the temporary inconvenience caused by this change, to those who are more familiar with the older arrangements, will be more than counterbalanced by the advantages which will follow acquaintance with the present one.

The committee were in doubt as to whether it would not be wiser to adopt the Engler-Prantl family names. Such would be the consistent course and, doubtless, some will criticise the failure to follow it. Since it involved the breaking up of several of the familiar groups like Rosaceae, Leguminosae, etc., it was decided that the argument of present convenience to most members of the club outweighed that of consistency.

In indicating the degree of frequency of occurrence, four adjectives have been used with a careful attempt at precision, namely, "common," "frequent," "occasional," "rare." In each case this statement regarding frequency is to be associated with the accompanying statement regarding habitat,—thus "sandy soil, common" means common on sandy soils; and such a plant may be rare in other habitats. The term "rare" has been reserved for those plants which are known to occur in but few stations and there but sparingly. Where they are abundant in such stations the word "local" has been preferred. In cases where but four or five stations

or less were known, these have been enumerated. It is always a matter of justice to botanical explorers and of interest and stimulus to others to insert the name of the station and of the discoverer of a rare plant, and the aim of the committee has been to do this so far as compatible with the brevity required. The habitats given are based on observations made in Vermont. Where these differ from those given in the standard botanies it is believed that the statements of this list more accurately define the local conditions.

Small capitals are used in the Catalogue for the names of foreign plants or of those not indigenous to the northeastern United States, that is to the region covered by the Gray Manual. In this the familiar usage of Gray's botanies has been followed. The distinction is somewhat helpful, but since it does not indicate the native Vermont flora with the exactness desired, a Supplementary List has been prepared which includes the names of those plants which are natives of the northeastern United States, and therefore printed in full-face type in this catalogue but which are not natives of Vermont.

The committee desires to acknowledge the generous assistance in the work of many other members of the Vermont Botanical Club. Especial mention should be made of the contributions of Dr. A. J. Grout whose specimens and notes were placed in the hands of the committee and of Mr. Clifton D. Howe who made the final copy of the manuscript for the printers and helped to handle the proof.

Dr. B. L. Robinson and Mr. M. L. Fernald have examined many doubtful specimens and have advised throughout in matters of nomenclature. Professor F. Lamson-Scribner critically examined the Vermont specimens of several of the genera of Gramineæ and contributed notes which add much to the accuracy of their treatment. Dr. C. W. Swan also gave valuable advice in this group. Dr. M. A. Howe has contributed the results of his own explorations and has reported upon various plants in the herbarium of the New York Botanic gardens.

To these gentlemen for their courteous assistance and kindly interest, the Vermont Botanical Club is greatly indebted.

EZRA BRAINERD,
L. R. JONES,
W. W. EGGLESTON,

Committee.

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FLORA OF VERMONT

PTERIDOPHYTA. FERN PLANTS

OPHIOGLOSSACEAE. ADDER'S TONGUE FAMILY

BOTRYCHIUM

B. lanceolatum, Angstroem. Moist hollows in cool open woods; rare.

B. matricariaefolium, Braun. Rich moist woods; occasional. A reduced form also occurs (B. tenebrosum, A. A. Eaton.)

B. simplex, Hitchcock. Hilly pastures and open woods; occasional.

B. ternatum, Swartz. var. **dissectum,** Milde. (B. dissectum, Spreng.) Cool loamy soil of open fields; occasional.

B. ternatum, Swartz. var. **intermedium,** D. C. Eaton. (B. obliquum, Muhl. var. intermedium, Underw.) Old pastures and copses; occasional.

B. ternatum, Swartz. var. **obliquum,** Milde. (B. obliquum, Muhl.) Moist gravelly slopes along the base of the mountains; frequent.

B. ternatum, Swartz. var. **rutaefolium,** D. C. Eaton. (B. matricariae, Spreng.) Old fields; rare.

B. Virginianum, Swartz. Rich woods; common.

OPHIOGLOSSUM. ADDER'S TONGUE

O. vulgatum, L. Muck; occasional.

FILICES. FERN FAMILY

ADIANTUM. MAIDENHAIR

A. pedatum, L. Rich moist woods; common.

ASPIDIUM (DRYOPTERIS) SHIELD FERN

A. acrostichoides, Swartz. Christmas Fern. Rocky woods; common and variable.

A. acrostichoides, Gray. var. **incisum,** Gray. Occasional.

A. **aculeatum,** Swartz. var. **Braunii,** Koch. (D. Braunii, Underw.) Smuggler's Notch, Pursh, 1807, is the type station. Moist woods above 2,000 feet altitude; occasional.

A. **Boottii,** Tuckerman. Wet thickets and about ponds; occasional.

A. **cristatum,** Swartz. Moist thickets and swamps; frequent.

A. **cristatum,** Swartz. var. **Clintonianum,** Eaton. Swampy woods; frequent.

A. **fragrans,** Swartz. Mt. Mansfield, Bolton Notch and Camel's Hump, *Pringle;* Mt. Zion, (Hubbardton), *Ross* and *Eggleston.*

A. **Goldianum,** Hook. Rich moist woods; occasional.

A. **marginale,** Swartz. Rocky woods; common.

A. **Noveboracense,** Swartz. Moist woods and swamps; common.

A. **spinulosum,** Swartz. Damp woods; occasional.

A. **spinulosum,** Swartz. var. **dilatatum,** Hook. Mountain woods; common above 2,500 feet altitude.

A. **spinulosum,** Swartz. var. **intermedium,** D. C. Eaton. Woodlands; common.

A. **Thelypteris,** Swartz. Swamps and wet places; common.

A. **marginale × cristatum,** Davenport. Cold bog, Shrewsbury, *Eggleston;* Pittsford, *Miss M. Slosson.*

ASPLENIUM. Spleenwort

A. **angustifolium,** Michx. Rich moist woods; occasional.

A. **ebeneum,** Ait. (A. platyneuron, Oakes.) Rocky woods; frequent.

A. **ebenoides,** R. R. Scott. Rutland, *Ross.* One plant, now in Herb. Univ. Vt.

A. **Filix-foemina,** Bernh. Moist woods; common and variable.

A. **Ruta-muraria,** L. Limestone cliffs of western Vermont; occasional. L. Willoughby, *E. Faxon, F. A. Winslow.*

A. **thelypteroides,** Michx. (A. acrostichoides, Sw.) Rich woods; frequent.

A. **Trichomanes,** L. Shaded cliffs; frequent.

A. **Trichomanes,** L. var. **incisum,** Moore. Brattleboro, *Frost, Miss A. L. Grout;* Norwich, *Jesup.*

A. **viride,** Hudson. Cliffs, Mt. Mansfield and Camel's Hump, *Pringle.*

CAMPTOSORUS. Walking Fern

C. **rhizophyllus,** Link. Shaded rocks, especially limestone; locally common in western Vermont.

CYSTOPTERIS

C. bulbifera, Bernh. Moist shaded ravines; frequent.

C. fragilis, Bernh. Rocky woods and ravines; common.

DICKSONIA

D. pilosiuscula, Willd. (D. punctiloba, Gray.) Hilly pastures; common.

ONOCLEA

O. sensibilis, L. Sensitive Fern. Moist meadows and thickets; common. The form **obtusilobata,** Charlotte, *Pringle.*

O. Struthiopteris, Hoffmann. Ostrich Fern. Rich alluvial soil; common.

OSMUNDA.

O. cinnamomea, L. Cinnamon Fern. Wet woods and pastures; common. The form **frondosa,** Charlotte, *Pringle;* Randolph, *Bates.*

O. Claytoniana, L. Wet woods and pastures; common.

O. regalis, L. Wet woods and swamps; common.

PELLÆA

P. atropurpurea, Link. Limestone cliffs; occasional in western Vermont, Lake Willoughby, *E. Faxon.*

P. gracilis, Hook. (P. Stelleri, Watt.) Moist limestone rocks; occasional.

PHEGOPTERIS. Beech Fern

P. Dryopteris, Fee. Rocky woods; common.

P. hexagonoptera, Fee. Rich woods; occasional.

P. polypodioides. Fee. (P. Phegopteris, Underw.) Damp woods; common.

POLYPODIUM. Polypody

P. vulgare, L. Rocks; common.

PTERIS. Bracken

P. aquilina, L. Pastures and woodlands; common.

WOODSIA

W. glabella, R. Br. "Willoughby Lake," *Torrey;* Mt. Mansfield and Bakersfield, *Pringle;* Quechee Gulf, *Balch.*

W. hyperborea, R. Br. (W. alpina, S. F. Gray.) Mt. Mansfield and Willoughby, *Pringle;* Quechee Gulf, *Balch.*

W. Ilvensis, R. Br. Rocks; common.

W. obtusa, Torr. Rocky banks and ledges; occasional.

WOODWARDIA. CHAIN FERN.

W. **Virginica,** Smith. Fort Ethan Allen pond, *Robbins;* Franklin bog, *Wild.*

EQUISETACEAE. HORSETAIL FAMILY

EQUISETUM. HORSETAIL

E. **arvense,** L. Moist gravelly or sandy banks; common.

E. **hiemale,** L. Moist gravelly banks; common.

E. **limosum,** L. (E. fluviatile, L.) Shallow water with muddy bottom; common.

E. **limosum,** L. var. **polystachyum,** Brueckner. Burlington, *Mrs. Flynn.*

E. **littorale,** Kuehlewein. Gravelly shores of Lake Champlain; rare.

E. **palustre,** L. Wet sandy shore of Lake Champlain, Burlington, *Grout* and *Jones.*

E. **scirpoides,** Michx. Moist cool woods; occasional.

E. **sylvaticum,** L. Moist shady places; common.

E. **variegatum,** Schleicher. Gravelly shores; occasional.

LYCOPODIACEAE. CLUB MOSS FAMILY

LYCOPODIUM. CLUB MOSS

L. **annotinum,** L. Cold woods; common.

L. **annotinum,** L. var. **pungens,** Spring. Summit Mt. Mansfield, *Pringle.*

L. **clavatum,** L. Dry woods; common.

L. **complanatum,** L. Woods and thickets; common.

L. **complanatum,** L. var. **Chamaecyparissus,** Milde. Newfane, *Howe* and *Lloyd;* Stowe, *Mrs. Straw.*

L. **inundatum,** L. Moist soil; occasional.

L. **inundatum,** L. var. **Bigelovii,** Tuckerm. Sunderland, *Grout.*

L. **lucidulum,** Michx. Cold damp woods; common.

L. **obscurum,** L. var. **dendroideum,** D. C. Eaton. Moist woods; common.

L. **sabinaefolium,** Willd. Cold, mountain woods, Rochester, *Eggleston.*

L. **Selago,** L. Summits of Mansfield and Camel's Hump, *Robbins;* Smuggler's Notch, *Pringle;* Johnson, *Eggleston.*

SELAGINELLACEAE

ISOETES

I. echinospora, Durieu. var. **Braunii,** Engelm. Margins of ponds and streams; common.

I. echinospora, Durieu. var. **muricata,** Engelm. "Mouth of Pompanoosuc river, Norwich," *Jesup.*

I. echinospora, Durieu. var. **robusta,** Engelm. Miry borders of bogs, northern L. Champlain ; occasional.

I. lacustris, L. "Brattleboro," *Frost;* Alburgh, *Eggleston.*

SELAGINELLA

S. apus, Spring. Moist shady places, Brattleboro, *Grout.*

S. rupestris, Spring. Dry exposed rocks ; frequent

SPERMATOPHYTA. SEED PLANTS
GYMNOSPERMS

CONIFERAE. PINE FAMILY

ABIES. Balsam Fir

A. balsamea, Miller. Cold, wet woods and swamps; common.

JUNIPERUS. Juniper

J. communis, L. var. **alpina,** Gaud. (J. nana. Willd.) Common Juniper. Dry sterile hills; frequent.

J. Sabina, L., var. **procumbens,** Pursh. "West Rutland," *Mrs. Carr;* Manchester, *Miss M. A. Day.*

J. Virginiana, L. Red Juniper. Dry, rocky hills. Frequent in the Champlain and lower Connecticut valleys.

LARIX. Larch

L. Americana, Michx. Tamarack. Cold swamps; common.

PICEA. Spruce

P. alba, Link. (P. Canadensis, B. S. P.) White Spruce. Common in northeastern Vermont also on Providence Island.

P. nigra, Link. (P. Mariana, B. S. P.) Swamp or Black Spruce. Common in sphagnum swamps of the Champlain and upper Connecticut valley. The dwarf form, var. **semiprostrata,** occurs on the summit of Mt. Mansfield, *Eggleston.*

P. rubra, Link. (P. nigra, var. rubra Engelm.; P. rubens, Sarg.) Red Spruce. Common, especially on rocky mountain sides.

PINUS. Pine

P. Banksiana, Lambert. (P. divaricata, Sudw.) Jack Pine. Monkton, *Robinson;* Starksboro, *Pringle;* Fairfax, *Bates.* But few trees at each station.

P. resinosa, Ait. Red or Norway Pine. Dry rocky soil; frequent.

P. rigida, Mill. Pitch Pine. Barren sandy soil. Common in the northern Champlain valley, less frequent in the Connecticut valley.

P. Strobus, L. White Pine. Common, especially in the Champlain and Connecticut valleys.

TAXUS. Yew

T. Canadensis, Willd. (T. minor. Britton.) Ground Hemlock. Moist banks and hills; frequent.

THUYA. Arbor Vitæ

T. occidentalis, L. Commonly but wrongly called White Cedar. Swamps and rocky banks; common.

TSUGA. Hemlock

T. Canadensis, Carr. Rocky woods and swamps; common.

ANGIOSPERMS. MONOCOTYLEDONS

TYPHACEAE. CAT-TAIL FAMILY

SPARGANIUM. Bur-reed

S. androcladum, Morong. (S. simplex, Huds., var. androcladum, Engelm.) Bogs and shallow water; common.

S. androcladum, var, **fluctuans.** Morong. (S. simplex, Huds. var. fluitans, Engelm.) Floating in ponds; occasional.

S. eurycarpum, Engelm. Borders of ponds and rivers; frequent in western Vermont.

S. minimum, Fries. Marshy borders of ponds; occasional.

S. simplex, Huds. Marshy borders of ponds and streams; frequent.

S. simplex, Huds., var. **angustifolium,** Engelm. Shallow water in mountain ponds; occasional.

TYPHA. Cat-tail

T. angustifolia, L. Along railroad, Charlotte, *Pringle;* Manchester, *Miss Day.*

T. latifolia, L. Marshes; common.

NAIADACEAE. POND-WEED FAMILY

NAIAS

N. flexilis, Rostk. & Schmidt. Slow streams and ponds; common.

POTAMOGETON. Pondweed

P. alpinus, Balbis. (P. rufescens, Schrad.) Windsor, *Jesup;* Willoughby Lake, *E. Faxon;* Lewis Creek, Ferrisburgh, *E. & C. E. Faxon;* Harvey's pond, W. Barnet, *Blanchard;* Little Averill pond, *Eggleston.*

P. amplifolius, Tuckerm. Common. Fruiting more commonly at high altitudes.

P. diversifolius, Raf. (P. hybridus, Michx.) "South Hero," *Robbins;* "Brattleboro," *Frost;* Vernon, *Grout;* Willoughby, *Jesup.*

P. Faxoni, Morong. Abundant in the still water of Lake Champlain and in the creeks entering into it. No mature fruit has been collected.

P. foliosus, Raf. (P. pauciflorus, Pursh.) Lewis Creek, Ferrisburgh, *C. E. Faxon;* W. Barnet, *Blanchard;* Brattleboro, *Grout;* Ponds in Woodbury, *Brainerd.* Winooski R., Burlington, *Mrs. Flynn.*

P. Friesii, Ruprecht. (P. mucronatus, Schrad.). Frequent.

P. heterophyllus, Schreb. Common.

P. heterophyllus, Schreb. var. **graminifolius,** Wats. &. Coult. Knights' Island, L. Champlain, *Brainerd.*

P. lonchites, Tuckerm. (P. fluitans, Roth.) Usually in sluggish streams; frequent.

P. lucens, L. Common.

P. lucens, L. var. **Connecticutensis,** Robbins. Lake Dunmore, *E. Faxon;* Lake Bomoseen, *Eggleston.*

P. natans, L. Pools and ditches; common.

P. Nuttalli, Cham. (P. Pennsylvanicus, Cham.) Common.

P. Oakesianus, Robbins. Grout pond, Stratton; Lily pond, Vernon, *Grout.*

P. obtusifolius, Mertens & Koch. Fairlee Lake, *Jesup* and *Sargent;* Little Otter Creek, Ferrisburgh, *Grout* and *Eggleston*; Lewis Creek, *Faxon.*

P. pectinatus, L. Common.

P. perfoliatus, L. Common.

P. perfoliatus, L. var. **lanceolatus,** Robbins. Lake Champlain and tributaries; frequent.

P. praelongus, Wulf. In deep water; frequent.

P. pusillus, L. Common.

P. Robbinsii, Oakes. Common.

P. Spirillus, Tuckerm. Common.

P. Tuckermani, Robbins. Grout pond, Stratton, *Grout.*

P. Vaseyi, Robbins. Oozy pond, Barnet, *Blanchard.*

P. Zizii, Mertens & Koch. Alburg, *Morong;* Milton, *Grout.*

P. zosteraefolius, Schum. Common.

SCHEUCHZERIA

S. palustris, L. Peaty bogs; occasional.

ZANNICHELLIA

Z. palustris, L. Shallow water, S. Hero, *Robbins;* N. Hero, *Pringle;* Norwich, *Jesup;* Joe's Pond, (W. Danville,) *Blanchard.*

ALISMACEAE. WATER-PLANTAIN FAMILY

ALISMA. Water-plantain

A. Plantago-aqatica, L. Swales; common.

SAGITTARIA. Arrow-leaf

S. arifolia, Nutt. Swales and wet shores, Grand Isle county, *Brainerd;* Barnard Pond, *Jesup* and *Sargent.*

S. graminea, Michx. Low muddy shores of lakes and ponds; frequent.

S. rigida, Pursh. (S. heterophylla, Pursh.) Low muddy shores; frequent.

S. latifolia, Willd. (S. variabilis, Engelm.) Wet places; very common. Many forms of this variable plant are recognized in the monograph of J. G. Smith, Sixth Report, Mo. Bot. Garden, 1895. Of these the forms c. and d. as well as the type are found in Vt.

HYDROCHARIDACEAE

ELODEA. (PHILOTRIA.)

E. Canadensis, Michx. Slow streams and ponds; frequent.

VALLISNERIA. Eel-grass

V. spiralis, L. Quiet, shallow water; common.

GRAMINEAE. GRASS FAMILY

AGROPYRON [1]

A. caninoides, Beal. (A. violaceum, Lange in part.) Dry warm rocky woodlands and ledges; frequent.

A. caninum, Beauv. Moist ledges, Burlington, *Jones*.

A. Novae-Angliae, sp. nov. (F. Lamson-Scribner ined. See remarks in footnote.) Cliffs of Lake Willoughby and Smuggler's Notch.

A. REPENS, Beauv. Quack-grass. Witch-grass. Fields; common.

AGROSTIS

A. ALBA, L. Moist places; common and extremely variable. Forms with more stoloniferous habit, *A. stolonifera* L., are frequent on wet banks and in lawns. A viviparous form occurs, Lake Willoughby, *Jones*.

A. ALBA, L. var. VULGARIS, Thurb. Red-top. Common in fields and roadsides. Variable and intergrading with the species. A small form occurs in cool pastures, sometimes having flowering glume awned; Burlington and Lake Willoughby, *Jones*.

A. canina, L. var. **alpina,** Oakes. (A. rubra, L.) Summit of Mt. Mansfield and of Camel's Hump.

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1 There is some doubt at present as to what is the best interpretation of our Agropyrons. All available specimens have been submitted to Professor Scribner and the above disposition meets his approval. *A. caninum* is a European species and when found in eastern America is usually regarded as introduced. Apparently the Burlington plant was native. *A. caninoides* was founded upon western types, and the Vermont plants referred to this differ somewhat from the western plants. This disposition of them may therefore be regarded as a provisional one, not altogether satisfactory. Of the new species proposed Professor Scribner writes, Sept. 19, 1900, "In regard to the Agropyron for which I have proposed the name *Novae-Angliae*, I must think it quite distinct from the *A. tenerum* of the west, although it suggests that species somewhat in habit. It looks more like a caespitose form of *A. repens*. I believe it has been included under *A. violaceum* by some authors, but it certainly is distinct from that species, as represented in our herbarium, from northern Europe and from the Rocky Mountain region."

A. intermedia, Scribn. Shaded places, Waterbury, *Pringle;* Burlington, *Jones.*

A. perennans, Tuckerm. Moist shaded places ; frequent.

A. scabra, Willd. (A. hyemalis, B. S. P.) Dry ditches and other desiccated places ; common.

ALOPECURUS

A. geniculatus, L. (A. geniculatus, L. var. aristulatus, Torr.) Water Foxtail. Wet meadows ; frequent.

A. PRATENSIS, L. Meadow Foxtail. Occasionally introduced in fields. "Bellows Falls," *Carey;* Hartland, *Ruggles;* Burlington, *Jones.*

AMMOPHILA

A. arundinacea, Host. (A. arenaria, Link.) Sandy shores of Lake Champlain, Alburgh, *Pringle.*

ANDROPOGON

A. provincialis, Lam. (A. furcatus, Muhl.) Dry rocky river banks ; occasional.

A. nutans, L. var. **avenaceus,** Hack. (Chrysopogon nutans, Benth. C. avenaceus, Benth.) Dry sandy soil ; occasional.

A. scoparius, Michx. Dry sterile soil ; occasional.

ANTHOXANTHUM. SWEET VERNAL-GRASS

A. ODORATUM, L. Occasional in old meadows and roadsides.

ARISTIDA

A. dichotoma, Michx. Barren fields ; "Pownal," *Robbins;* New Haven, *Pringle.*

A. gracilis, Ell. Dry pastures ; Vernon, *Grout.*

ARRHENATHERUM. TALL OAT-GRASS

A. AVENACEUM, Beauv. (A. elatius, Beauv.) Charlotte, *Horsford;* Burlington, *Jones.*

ASPERELLA. (ASPRELLA. HYSTRIX)

A. Hystrix, Humb. (Gymnostichum Hystrix, Schreb.) Rocky woods ; frequent.

AVENA

A. striata, Michx. Rocky woods ; frequent.

BRACHYELYTRUM

B. erectum, Beauv. (B. aristatum, R. & S.) Moist shaded places; frequent.

BRIZA

B. MEDIA, L. Adventive in old meadow, Charlotte, *Pringle.*

BROMUS[1]

B. ciliatus, L. Moist thickets ; common.

B. ERECTUS, Huds. Adventive, Charlotte, *Pringle.*

B. Kalmii, Gray. Dry woodlands ; occasional.

B. purgans, L. (B. ciliatus, L. var. purgans, Gray.) Thickets ; common.

B. RACEMOSUS, L. Adventive, Charlotte, *Pringle.*

B. SECALINUS, L. Chess. Occasional in fields and waste places.

B. TECTORUM, L. Adventive, Charlotte, *Pringle.*

CALAMAGROSTIS[2]

C. breviseta, Scribn. (C. Pickeringii, Gray.) "Vermont," *Pringle.* Specimen in U. S. national herbarium.

C. breviseta, Scribn. var. **lacustris,** Kearney. (C. Lapponica, Gray in part.) Mt. Mansfield, *Pringle.* Specimen in U. S. national herbarium.

C. Canadensis, Beauv. Blue-joint. Marshes and wet places ; common.

C. hyperborea, Lange. Lake Willoughby, *Boott.* Specimen in U. S. national herbarium.

C. hyperborea, Lange. var. **Americana,** Kearney. Lake Willoughby, *Mann;* Mt. Mansfield, *Pringle.*

C. inexpansa, Gray. (C. confinis, Gray.) Mt. Mansfield, *Pringle;* Lake Willoughby cliffs.

C Langsdorfii, Trin. Mt. Mansfield, *Pringle;* Lake Willoughby, *Rusby.*

CENCHRUS

C. tribuloides, L. Sandy shores of Connecticut River, Brattleboro, *Grout.*

CHAETOCHLOA[3] (SETARIA, IXOPHORUS)

C. ITALICA, Scribn. var. GERMANICA, Scribn. Hungarian-grass. Occasionally adventive, but not long persistent.

1. See Shear, C. L. Rev. N. A. Species Bromus. U. S. Dept. Agr. Div. Agros. Bul. 23, 1900.

2 See T. H. Kearney, Jr., A Revision of N. A. Species of Calamagrostis, U. S. Dept. Agr. Div. Agrost. Bul. 11, 1898. Kearney's nomenclature has been followed in this genus, although it is not entirely consistent with the system followed elsewhere in the present catalogue.

3 See Scribner and Merrill, N. A. Species of Chaetochloa, U. S. Dept. Agr. Div. Agrost. Bul. 21, 1900.

C. GLAUCA, Scribn. Yellow Foxtail. Fields; common.

C. VERTICILLATA, Scribn. Old garden, Burlington, *Jones.*

C. VIRIDIS, Scribn. Green Foxtail. Fields and waste places; common.

CINNA

C. **arundinacea,** L. Moist woods; frequent.

C. **pendula,** Trin. (C. latifolia, Griseb.) Moist woods, especially on mountain sides; frequent.

DACTYLIS

D. GLOMERATA, L. Orchard Grass. Common, preferring partial shade.

DANTHONIA

D. **compressa.** Aust. Dry banks and woods; occasional.

D. **spicata,** Beauv. Dry sterile soil; common.

DESCHAMPSIA

D. **atropurpurea,** Scheele. A single specimen collected on Mt. Mansfield by *Joseph Torrey*, probably before 1853, is in the University of Vermont herbarium. Later botanists have failed to rediscover it.

D. **caespitosa,** Beauv. Rocky banks and shores; frequent.

D. **flexuosa,** Trin. Dry soil, ascending to highest mountain tops; common.

EATONIA

E. **Dudleyi,** Vasey. (E. nitida, Nash.) Colchester, *Torrey.*

E. **Pennsylvanica,** Gray. Moist rocky woods and marshes; frequent.

ELYMUS

E. **Canadensis,** L. Low thickets and river banks; common.

E. **Canadensis,** L. var. **glaucifolius,** Gray. Dry banks; occasional.

E. **robustus,** Scribn. and Sm. Burlington, *Jones.*

E. **striatus,** Willd. Middlebury, *James, Brainerd;* ledges of Winooski River, *Pringle.*

E. **Virginicus,** L. Moist thickets of river banks; frequent.

ERAGROSTIS

E. MAJOR, Host. Burlington, Woodstock, *Jones;* Pownal, Bennington, *Eggleston;* railroad yard, Middlebury, *Brainerd.*

E. **pectinacea,** Steud. Dry sandy soil; frequent in the lower Connecticut valley.

E. Purshii, Schrader. Sandy soil, especially along railroads; occasional in southern Vt.; Burlington, *H. L. Priest.*

E. reptans, Nees. (E. hypnoides, B. S. P.) Gravelly or sandy banks; occasional.

FESTUCA

F. ELATIOR, L. Meadow Fescue. Common in old meadows and along roadsides. Variable in size, but most of the Vermont plants are of the smaller form, var. PRATENSIS, Gray.

F. nutans, Willd. Rocky woods; frequent.

F. ovina, L. Frequent as an introduced plant in lawns.

F. brachyphylla, Schultes. (F. ovina, L. var. brevifolia, Wats.) Cliffs of Smuggler's Notch; rare, *Grout* and *Eggleston.*

F. rubra, L. Rocky shores and islands of Lake Champlain, occasional; swamp, Stratton Mountain, *Jones.*

GLYCERIA. (PANICULARIA)

G. Canadensis, Trin. Wet places; common.

G elongata, Trin. Wet woods; frequent, especially among the mountains.

G. fluitans, R. Br. Wet places or shallow water; frequent. The Vermont specimens, so far as seen, are the form with smaller spikelets, viz. the var. **augustata,** Vasey, or **Panicularia borealis,** Nash. (See Bul. Torr. Bot. Club, 24: 348. 1897.)

G. grandis, Watson. (P. Americana, MacM.) Wet soil; common.

G. nervata, Trin. Wet meadows; common.

G. pallida, Trin. Shallow water or wet soil; frequent.

GRAPHEPHORUM

G. melicoideum, Beauv. Banks of Winooski River, Colchester and Willisiston, *Pringle;* South Burlington, *Jones.*

HIEROCHLOE. (SAVASTANA)

H. alpina, R. & S. Summit of Mt. Mansfield, *Tuckerman* and *Macrae.*

H. borealis, R. & S. (S. odorata, Scribn.) Moist meadows; occasional.

HOLCUS

H. LANATUS, L. Fields, Charlotte, *Pringle* and *Horsford;* Peacham, *Blanchard.*

HORDEUM

H. jubatum, L. Strafford, *Collins;* probably introduced in grass seed.

LEERSIA. (HOMALOCENCHRUS)

L. oryzoides, Swartz. Wet places; common.

L. Virginica, Willd. Wet woods; frequent.

LOLIUM

L. perenne, L. Rye-grass. Adventive in roadsides and meadows; occasional.

MILIUM

M. effusum, L. Cool moist woods, especially among the mountains; frequent.

MUHLENBERGIA

M. diffusa, Schreber. Shaded places; occasional.

M. glomerata, Trin. (M. racemosa, B. S. P.) Wet rocks and marshy places; frequent and variable.

M. Mexicana, Trin. Moist meadows and banks; common.

M. sylvatica, Torr. & Gray. Moist rocky banks; occasional.

M. Willdenovii, Trin. (M. tenuiflora, B. S. P.) Rocky woods; occasional.

ORYZOPSIS

O. asperifolia, Michx. Woods: common.

O. Canadensis, Torr. (O. juncea, B. S. P.) Dry sand soil; occasional.

O. melanocarpa, Muhl. Rocky woods; frequent.

PANICUM

P. agrostoides, Muhl. Hartland, *Ruggles;* Newfane, *Grout.*

P. capillare, L. Fields, common.

P. clandestinum, L. Moist thickets; frequent.

P. Crus-galli, L. Barn-yard Grass. Waste places; common.

P. Crus-galli var. muticum, Vasey. With the type; occasional.

P. depauperatum, Muhl. Dry woods and fields; frequent.

P. glabrum, Gaudin. (Syntherisma linearis, Nash.) Sandy fields and waste places, lawns; common.

P. linearifolium, Scribn. Monkton, *Pringle;* Burlington, *Jones;* Snake Mt., *Hazen.*

P. macrocarpon, Le Conte. (P. latifolium, of Gray Manual in part.) Woodlands; frequent.

P. sanguinale, L. (Syntherisma sanguinalis, Nash.) Gardens and waste places; common.

P. Scribnerianum, Nash. (P. scoparium, of Gray Manual) Brattleboro, *Grout.*

P. virgatum, L. Brattleboro, *M. A. Howe.*

P. xanthophysum, Gray. Dry sandy soil; frequent. The form **amplifolium,** Scribner, ined., Burlington, *Jones.*

Panicum dichotomum of Gray's Manual, etc., is at present conceived to include a number of closely related forms. The specific distinctions are not well established, however, and the nomenclature is in a confused state. All available Vermont specimens have been submitted to Professor Scribner and he recognizes among them the following species. There are numerous other forms, especially in the *pubescens* group which it is not possible as yet to name satisfactorily.

P. Atlanticum, Nash (?) Dry woods and sandy lake shore, Burlington, *Jones, Hazen.*

P. boreale, Nash. Woods and fields ; frequent.

P. Columbianum, Scribn. (P. psammophilum, Scribn.) Dry sandy soil ; frequent about Burlington.

P. dichotomum, L. Burlington, *Jones ;* Rutland, *Eggleston.*

P. implicatum, Scribn. Charlotte, *Pringle.*

P. lanuginosum, Ell. Hartland, *Ruggles ;* Middlebury, Wallingford, *Brainerd.*

P. pubescens, of recent authors (not Lamarck.) Leicester, *Brainerd.*

P. sphaerocarpon, Ell. Sterling Mt., *Eggleston.*

P. tsugetorum, Nash. Burlington, *Jones.*

PASPALUM

P. setaceum, Michx. Sandy fields ; "Bellows Falls," *Carey ;* Hartland, *Ruggles ;* Vernon, *Grout.*

PHALARIS

P. arundinacea, L. Reed Canary-grass. Wet soil or shallow water ; frequent.

P. ARUNDINACEA, L. var. PICTA (Hort.) Ribbon Grass. Common in gardens and occasionally adventive.

P. CANARIENSIS, L. Canary-grass. Waste places ; occasional and adventive.

PHLEUM

P. PRATENSE, L. Timothy. Fields ; common.

PHRAGMITES

P. communis, Trin. (P. Phragmites, Karst.) Swampy margins of ponds and lakes ; occasional.

POA

P. alsodes, Gray. Moist woods ; common.

P. ANNUA, L. Waysides and fields ; common.

P. COMPRESSA, L. English Blue-grass. Dry fields and woodlands; common.

P. **debilis,** Torr. Dry rocky woodlands; frequent.

P. **flava,** L. (P. serotina, Ehrh.) Fowl Meadow-grass. Wet soil; common. The form known in Europe as *P. fertilis*, Reich. also occurs at Burlington, *Jones*, probably introduced.

P. **laxa,** Haenke. Summit of Mt. Mansfield, *Robbins*.

P. **nemoralis,** L. Rocky woodlands and mountain cliffs; occasional and variable. A form, var. **strictior,** Gray, from the islands and headlands of Lake Champlain is of erect habit, and approaches *P. caesia*, Smith.

P. **pratensis,** L. Kentucky Blue-grass. Pastures and fields; common.

P. **pratensis,** L. var. **angustifolia,** Smith. Groton Pond, *Bates;* bog, Lake Willoughby, *Jones*.

SPARTINA

S. **cynosuroides,** Willd. "Bellows Falls," *Carey*. Shores of Lake Champlain and tributaries; frequent.

SPOROBOLUS

S. **asper,** Kunth. Thompson's Point, *Pringle*.

S. **serotinus,** Gray. Wet soil; Ripton, *Boyce;* Bakersfield, *Pringle;* Peacham, *Blanchard;* frequent in elevated bogs of Windham county, *Grout*.

S. **vaginaeflorus,** Wood. Dry soil; occasional and variable. The commoner forms represent *S. neglectus*, Nash. Plants found at Burlington, *Jones*, correspond to *S. minor*, Vasey. Professor Scribner has examined these, however, and decides that all are included in Wood's species.

TRISETUM

T. **subspicatum,** Beauv. (T. subspicatum, Beauv. var. molle, Gray.) Dry woods and ledges; occasional.

ZIZANIA

Z. **aquatica,** L. Marshy borders of Lake Champlain and its tributaries; occasional.

CYPERACEAE. SEDGE FAMILY

CAREX. Sedge

C. albicans, Willd. Dry shady ledges; common in Western Vermont. For description see Bot. Gaz. 21: 7. 1896.

C. alopecoidea, Tuckerm. Wet meadows; Middlebury, *Brainerd;* Burlington, *T. E. Hazen.*

C. aquatilis, Wahl. Borders of ponds and rivers; occasional.

C. arctata, Boott. Moist woodlands; common.

C. atrata, L. var. **ovata,** Boott. (C. atratiformis, Britton.) Smugglers' Notch, *Pringle.*

C. aurea, Nutt. Moist meadows; common.

C. Backii, Boott. (C. durifolia, Bailey.) Shaded ledges; occasional.

C. bromoides, Schkuhr. Bogs and swamps; common.

C. canescens, L. Swamps; occasional.

C. canescens, L. var. **alpicola,** Wahl. (C. brunnescens, Poir.) Summits of Green Mountains.

C. canescens, var. **polystachya,** Boott. (C. arcta, Boott.) Low woods; Peacham, *Blanchard;* Knight's Island, *Brainerd;* Highgate Springs, *Jesup.*

C. canescens, L. var. **vulgaris,** Bailey. (C. brunnescens, Poir. var. gracilior, Britton.) Moist woodlands; common.

C. castanea, Wahl. Low meadows; local, e. g. Pomfret, Barnet, Middlebury.

C. cephaloidea, Dewey. Moist woodlands; Middlebury, *Burt;* Hartford, *Bates.*

C. cephalophora, Muhl. Fields and woods; common.

C. chordorhiza, Ehrh. Cold bogs; Bristol Pond, *Pringle;* "Eastern Vermont," *Congdon;* Perch Pond, *J. R. Churchill;* Colchester, *Jones, Grout.*

C. communis, Bailey. (C. pedicellata, Britton.) Dry hillsides; common.

C. communis, Bailey, var. **Wheeleri,** Bailey. Dry rocky woods; occasional.

C. conoidea, Schkuhr. Moist meadow; occasional.

C. crinita, Lam. Swales and along brooks; common.

C. debilis, Michx. var. **Rudgei,** Bailey. (C. tenuis, Rudge.) Frequent in moist sterile soil along the mountains.

C. deflexa, Hornem. Moist thicket, bordering Abby Pond, Ripton, *Brainerd;* Peacham, *Blanchard.*

C. deflexa, Hornem. var. **Deanei,** Bailey. Groton, *Pringle.*

C. **Deweyana,** Schwein. Dry woodlands; common.

C. **digitalis,** Willd. Dry open woods; frequent.

C. **eburnea,** Boott. (C. setifolia, Britton.) Frequent on dry shaded limestone.

C. **exilis,** Dewey. Peat bogs; Bristol, *Pringle;* Peacham, *Blanchard.*

C. **filiformis,** L. Peaty borders of ponds; frequent.

C. **filiformis,** L. var. **latifolia,** Boeckl. (C. lanuginosa, Michx.) Swales and low meadows; frequent.

C. **flava,** L. Low meadows; common.

C. **flava,** L. var. **graminis,** Bailey. Wet margins of springs and low borders of ponds; common.

C. **flava,** L. **viridula,** Bailey. (C. viridula, Michx.) Shores of lakes and rivers; Fairlee Lake, *Blanchard;* Pomfret, *Morgan;* White River, *Flint.*

C. **foenea,** Willd. Dry woods, often on rocks; rare.

C. **foenea,** Willd. var. **perplexa,** Bailey. Dry copses; Middlebury, *Brainerd;* Fairlee, *Blanchard;* Rutland, *Eggleston.*

C. **folliculata,** L. Cold swamps; Stratton and Marlboro Ponds, *Grout.*

C. **formosa,** Dewey. Moist meadows; Sunderland, *Eggleston;* Middlebury, *Brainerd.*

C. **fusca,** All. Bogs; "Burlington," *Torrey;* Fairlee, *Jesup;* Mendon, *Eggleston.*

C. **gracillima,** Schwein. Low meadows; common.

C. **granularis,** Muhl. Moist meadows; common.

C. **granularis,** Muhl. var. **Haleana,** Porter. Burlington, *T. E. Hazen.*

C. **Grayii,** Carey. (C. Asa-Grayi, Bailey.) Swales, along rivers and lakes; rare.

C. **grisea,** Wahl. Along brooks in thickets; occasional.

C. **gynandra,** Schwein. Wet ground, especially in the mountains; frequent.

C. **Hitchcockiana,** Dewey. Rich woods; occasional.

C. **Houghtonii,** Torr. Dry sandy banks; Norwich, *E. A. Edmunds;* Rutland, *Eggleston.*

C. **hystricina,** Muhl. Wet meadows; common.

C. **interior,** Bailey. (C. echinata, var. microstachys, of Gray Manual in part.) Boggy meadows; common.

C. **intumescens,** Rudge. Wet woods and pastures; common.

C. **laxiculmis,** Schwein. Moist copses; occasional.

C. **laxiflora,** Lam. Moist meadows; occasional.

C. **laxiflora,** Lam. var. **latifolia,** Boott. (C. Albursina, Sheldon.) Moist rich woods; frequent.

C. **laxiflora.** Lam. var. **patulifolia,** Carey. Rich woodlands; frequent.

C. **laxiflora,** Lam. var. **striatula,** Carey. (var. blanda, Boott.) moist meadows; common.

C. **laxiflora,** Lam. var. **varians,** Bailey. Copses and meadows; common.

C. **lenticularis,** Michx. Sandy borders of ponds and lakes; rare.

C. **leptalea,** Wahl. (C. polytrichoides, Muhl.) Wet woods and bogs; frequent.

C. **limosa,** L. Bogs; common.

C. **livida,** Willd. Bogs north of Bristol Pond, *Pringle.*

C. **longirostris,** Torr. Shady ledges; frequent.

C. **lupulina,** Muhl. Swamps and ditches; common.

C. **lupulina,** Muhl. var. **pedunculata,** Dewey. North Hero, *Brainerd;* Newfane, *Grout.*

C. **lupulina,** Muhl. var. **polystachya,** Schwein and Torr. (C. lupuliformis, Sart.) Marshes along Lake Champlain.

C. **lurida,** Wahl. Wet meadows; common.

C. **lurida,** Wahl. var. **gracilis,** Bailey. (C. Baileyi, Britton.) Bogs in the mountains; frequent.

C. **lurida,** Wahl. var. **parvula,** Bailey. Occasional.

C. **Magellanica,** Lam. Cold bogs; occasional.

C. **Michauxiana,** Boeckl. (C. abacta, Bailey.) Bogs and lake borders at high altitudes. Sterling Pond, *Pringle;* frequent in the elevated bogs of Windham county, *Grout;* Fifield Pond, Wallingford, *Eggleston;* also at Lake of the Clouds, Mt. Mansfield, from seed sown there by Mr. Pringle.

C. **monile,** Tuckerm. Swales; common.

C. **monile,** Tuckerm. var. **monstrosa,** Bailey. Occasional.

C. **Muhlenbergii,** Schkuhr. Dry sand, near Fort Ethan Allen, *Hazen.*

C. **Novae-Angliae,** Schwein. Shady knolls; Stratton, *Grout;* Chittenden, *Eggleston;* Underhill and Cambridge, *Brainerd;* also in an open sandy meadow near Brigham Academy, Bakersfield.

C. **oligocarpa,** Schuhr. Dry copses; rare. Middlebury, *Brainerd.*

C. **oligosperma,** Michx. Bogs; Peacham, *Blanchard;* Stratton, *Grout;* Sunderland, *Eggleston.*

C. **pallescens,** L. Low meadows; common.

C. **pauciflora,** Lightf. Sphagnum bogs; rare.

C. **pedunculata,** Muhl. Dry woods; frequent.

C. **Pennsylvanica,** Lam. Shady hillsides ; common.

C. **plantaginea,** Lam. Rich woods ; frequent.

C. **platyphylla,** Carey. Shady banks ; common.

C. **prasina,** Wahl. Springy bogs in woods ; occasional.

C. **Pseudo-Cyperus,** L. Swamps ; Knight's Island, *Brainerd ;* Barnet, *Blanchard.*

C. **Pseudo-Cyperus,** L. var. **Americana,** Hochst. Swamps ; occasional.

C. **pubescens,** Muhl. Rich woods ; Barnet, *Blanchard ;* occasionally in Addison county, *Brainerd.*

C. **retrorsa,** Schwein. Swamps ; common.

C. **retorsa,** Schwein. var. **Hartii,** Gray. (C. Hartii, Dewey.) marshes ; occasional.

C. **rigida,** Gooden. var. **Bigelovii,** Tuckerm. (C. Bigelovii, Torr.) Alpine summits of Green Mountains.

C. **rigida,** Gooden. var. **Goodenovii,** Bailey. (C. Goodenovii, J. Gay.) Wet meadows ; Peacham, *Blanchard.*

C. **riparia,** W. Curtis. Swales ; occasional.

C. **rosea,** Schkuhr. Rich woods ; common.

C. **rosea,** Schkuhr. var. **minor,** Boott. Willoughby Lake, *Wm. Boott.*

C. **rosea,** Schkuhr, var. **radiata,** Dewey. Shady knolls ; frequent.

C. **saltuensis,** Bailey. (C. altocaulis, Britton.) Deep swamps ; Sutton, *Pringle.*

C. **scabrata,** Schwein. Springy bogs in woods ; frequent.

C. **Schweinitzii.** Dewey. Swamps ; local. Pownal, *Dewey ;* Salisbury, *Brainerd ;* Manchester, *Miss Day.*

C. **scirpoidea,** Michx. Alpine cliffs, Willoughby Lake, Smuggler's Notch ; also Mt. Equinox, Manchester, *Miss Day.*

C. **scoparia,** Schkuhr. Moist meadows ; common.

C. **scoparia,** Schkuhr. var. **minor,** Boott. Rocky and sterile pastures.

C. **siccata,** Dewey. Sandy shore of Lake Champlain north of the Lake View Cemetery, Burlington.

C. **sparganioides,** Muhl. Rich woods ; frequent.

C. **squarrosa,** L. (C. typhinoides, Schwein.) Low borders of streams and lake margins in western Vermont ; occasional.

C. **sterilis.** Willd. (C. echinata, var. microstachys, Boeckl.) Wet meadows and pastures, especially in the mountains.

C. **sterilis,** Willd. var. **angustata,** Bailey. Mostly in shade at high altitudes.

C. **sterilis,** Willd. var. **excelsior,** Bailey. Wet margins of ponds and brooks.

C. **stipata,** Muhl. Swales; common.

C. **straminea,** Willd. Dryish copses and fields; common.

C. **straminea,** Willd. var. **brevior,** Dewey. (C. festucacea, Willd.) Gardner's Island, *Brainerd.*

C. **straminea,** Willd. var. **Crawei,** Boott. (C. Bicknellii, Britton.) Dry banks; occasional.

C. **straminea,** Willd. var. **mirabilis,** Tuckerm. Moist, shady places; occasional.

C. **stricta,** Lam. Swales and marshes; common.

C. **stricta,** Lam. var. **angustata,** Bailey. Manchester, *Miss Day.*

C. **stricta,** Lam. var. **curtissima,** Peck. Essex Junction, *Brainerd.*

C. **stricta,** Lam. var. **decora,** Bailey. (C. Haydeni, Dewey.) Barnet, *Blanchard.*

C. **tenella,** Schkuhr. Cold swamps; frequent.

C. **tenuiflora,** Wahl. Quaking bog, Bristol Pond, *Pringle;* Cedar swamp, Fair Haven, *Oakes;* Salem and Burlington, *Robbins;* Peacham, *Blanchard.*

C. **teretiuscula,** Gooden. Bogs; Bristol Pond, *Pringle;* Peacham, *Blanchard.*

C. **teretiuscula,** Gooden. var. **ramosa,** Boott. (C. prairea, Dewey.) Bristol Pond, *Brainerd;* Peacham, *Blanchard;* Rutland, *G. H. Ross.*

C. **torta,** Boott. Along mountain streams; frequent.

C. **tribuloides,** Wahl. Open swales; frequent.

C. **tribuloides,** Wahl. var. **Bebbii,** Bailey. Dry low grounds; common.

C. **tribuloides,** Wahl. var. **cristata,** Bailey. (C. cristatella, Britton.) Wet ground; frequent.

C. **tribuloides,** Wahl. var. **reducta,** Bailey. (var. moniliformis, Britton.) Moist copses; occasional.

C. **triceps,** Michx. var. **hirsuta.** Moist fields; occasional.

C. **trisperma,** Dewey. Cold bogs in shade; frequent.

C. **Tuckermani,** Dewey. Swales and marshes; frequent.

C. **umbellata,** Schkuhr. Rocky hills and dry knolls; frequent.

C. **umbellata,** Schkuhr. var. **vicina,** Dewey. In shade; occasional.

C. **utriculata,** Boott. Marshy borders of ponds; occasional.

C. utriculata, Boott. var. **minor**, Boott. With the species.

C. virescens, Muhl. Moist pastures ; occasional.

C. virescens, Muhl. var. **costata**, Dewey. (C. costellata, Britton.) Moist copses ; Middlebury, *Brainerd.*

C. vulpinoidea, Michx. Moist pastures ; common.

C. xanthocarpa, Bicknell. Moist meadows ; common in Addison county *Brainerd.*

C. arctata × castanea, Bailey. One plant, Middlebury, *Brainerd.*

C. lurida × lupulina, Bailey. North Hero, *Morong.*

C. stricta × torta, Fernald, n. hybr. "Culm tall, 7.5 dm. high, and strict as in *C. stricta ;* leaves linear, acute as in *C. torta*, much shorter and softer and with less attenuate tips than in *C. stricta;* bracts elongated, overtopping the culm ; spikes erect, 1.5 to 6 cm. long, the pistillate loosely flowered ; scales ovate-lanceolate, acute, dull brown with green middle and narrow pale margin : perigynia ovate-lanceolate, thin, dull green, nerveless, the elongate, generally empty, tip exceeding the scale and sometimes recurved. Mt. Mansfield, Vt., July 3, 1896, (G. G. Kennedy). Very clearly combining the characters of the two parents. In the foliage and in most of the perigynia like *C. torta ;* but in its tall, stiff habit, and acute scales like *C. stricta.*"—M. L. Fernald in letter.

CLADIUM

C. mariscoides, Torr. Low borders of ponds ; occasional.

CYPERUS

C. aristatus, Rottb. (C. inflexus, Muhl.) Wet sandy soil ; frequent.

C. dentatus, Torr. Sandy shores ; Fairlee Lake, *Jesup ;* Lily Pond, Vernon, *Grout ;* Grand Isle, *Pringle.*

C. diandrus, Torr. Low ground ; rare. Peacham, *Blanchard.* Wet sands of Connecticut River, Westminster, *Brainerd.*

C. diandrus, Torr. var. **castaneus**, Torr. (C. rivularis, Kunth.) Wet soil ; common.

C. esculentus, L. Alluvial soil ; occasional.

C. filiculmis, Vahl. Dry sands ; common.

C. Houghtonii, Torr. Fairlee Lake, *Jesup.*

C. strigosus, L. Moist soil ; frequent.

DULICHIUM

D. spathaceum, Pers. Borders of ponds ; frequent.

ELEOCHARIS. Spike-rush

E. acicularis, R. Br. Pools and shores below high water mark ; common.

E. diandra, C. Wright, var. **depressa,** Fernald. Wet sands of Connecticut River, Westminster, *Brainerd.* See Rhodora, 2: 60. 1900.

E. intermedia, Schultes. In mire or wet sands ; occasional.

E. obtusa, Schultes. (E. ovata, of recent manuals.) Muddy places ; common.

E. obtusa, Schultes. var. **jejuna,** Fernald. A dwarf form of drier ground ; frequent.

E. olivacea, Torr. Soft mire ; Bristol Pond, *Pringle ;* Abby Pond, Ripton and Lake Dunmore, *Brainerd.* Kenney Pond, Newfane, *Grout.*

E. ovata, R. Br. In soft black mire, inlet of Abby Pond, Ripton, *Brainerd ;* Spectacle Pond, Wallingford, *Eggleston.* Rare.

E. ovata, R. Br. var. **Heuseri,** Uechtritz. Dead mouth of inlet, Lake Dunmore, *Brainerd.* See Rhodora 1: 137. 1899.

E. palustris, R. Br. Low borders of ponds ; occasional.

E. palustris, R. Br. var. **calva,** Gray. Stony clay, shores of Lake Champlain ; occasional.

E. palustris, R. Br. var. **glaucescens,** Gray. Moist grassy places ; common.

E. palustris, R. Br. var. **vigens,** Bailey. Low sandy shores of Lake Champlain ; frequent.

E. pauciflora, Link. (Scirpus pauciflorus, Lightf.) Wet soil, Lyndon, *Congdon ;* Willoughby Mt., *Tuckerman.*

E. pygmaea, Torr. Near Willoughby Lake, *Walter Deane.*

E. tenuis, Schultes. Wet meadows and lake borders ; common.

ERIOPHORUM Cotton-grass

E. alpinum, L. Cold bogs, especially in mountains ; common.

E. gracile, Koch. Bogs ; Middlebury, Ripton, *Brainerd ;* Ryegate, *Blanchard.*

E. gracile, Koch. var. **paucinervium,** Engelm. Bogs ; occasional.

E. polystachyon, L. Springy hollows and bogs ; common.

E. vaginatum, L. Peat bogs ; occasional.

E. Virginicum, L. Peat bogs ; frequent.

FIMBRISTYLIS

F. autumnalis, R. & G. Lily Pond, Vernon, *Grout.*

F. capillaris, Gray. (Stenophyllus capillaris, Britton.) Dry sands ; rare.

RHYNCHOSPORA. Beaked-rush

R. alba, Vahl. Bogs; frequent.

R. capillacea, Torr. Willoughby Mountain, *Jesup;* Hartford, *Morgan.*

R. fusca, R. & S. Low grounds; Thetford, *Blanchard;* Wells River, *Horsford;* Thetford Centre, *Jesup.*

R. glomerata, Vahl. Moist soil; occasional.

SCIRPUS. Bulrush, Club-rush

S. atratus, Fernald, (Rhodora 2: 18. 1900). (S. Peckii, Britton, in part.) Moist meadows and borders of bogs in the mountains; occasional.

S. atrovirens, Muhl. Moist meadows; common.

S. atrocinctus, Fernald. (See Rhodora, 2:17 and 1:137.) Wet meadows; common, especially in the mountains.

S. atrocinctus, Fernald. var. **grandis,** Fernald. Ripton, *Brainerd.* (See Rhodora 2: 17. 1900.)

S. atrocinctus, Fernald. var. **brachypodus,** Fernald. Bogs at high altitudes; occasional.

S. caespitosus, L. Moist rocks of alpine summits; local.

S. cyperinus, Kunth. (Eriophorum cyperinum, L.) Wool-grass. Wet meadows; common.

S. cyperinus, Kunth. var. **Andrewsii,** Fernald. Middlebury, *Brainerd.*

S. cyperinus, Kunth. var. **condensatus,** Fernald. Middlebury and Ripton, *Brainerd.*

S. debilis, Pursh. Wet soil, Norwich, *Jesup;* Westminister, *Brainerd.*

S. fluviatilis, Gray. Marshy borders of bays and streams, Lake Champlain; occasional.

S. lacustris, L. In shallow water; common.

S. pedicellatus, Fernald. (Rhodora 2:16. 1900.) Swales; common.

S. pedicellatus, Fernald. var. **pullus,** Fernald. Swales and boggy margins of ponds; frequent.

S. planifolius, Muhl. Mount Philo, Charlotte, *Pringle.*

S. pungens, Vahl. (S. Americanus, Pers.) Sandy borders of lakes; frequent.

S. rubrotinctus, Fernald. (S. microcarpus, of Ill. Flora, Britton & Brown.) Wet meadows; common, especially in mountains.

S. Smithii, Gray. Keeler's Bay, Ferrisburgh, *E. Faxon;* mouth of Winooski River, *Grout* and *Tracy.*

S. subterminalis, Torr. Grout Pond, Stratton, *Grout;* Lake Dunmore, *Brainerd.*

S. Torreyi, Olney. Muddy shores, Fort Cassin, Ferrisburgh, *Brainerd;* Barnet, *Blanchard;* ponds of Windham Co., *Grout.*

ARACEAE

ACORUS

A. Calamus, L. Sweet Flag. Marshes; common.

ARISÆMA

A. Dracontium, Schott. Low grounds. "Shoreham," *Robbins;* Weybridge, *Brainerd.*

A. triphyllum, Torr. Indian Turnip. Rich woods; common.

CALLA

C. palustris, L. Wild Calla. Bogs and marshes; frequent.

PELTANDRA

P. undulata, Raf. Shallow water. Colchester Pond, *Robbins;* Middlebury, *Brainerd;* Bristol Pond, *Pringle;* Lake Bomoseen marshes, *Eggleston.*

SYMPLOCARPUS. (SPATHYEMA)

S. foetidus, Salisb. Skunk Cabbage. Wet places; occasional. Common about Burlington.

LEMNACEAE

LEMNA. Duckweed

L. minor, L. North Hero, *Robbins;* Highgate, *Jesup;* Thetford, *Blanchard;* Burlington, *Jones.*

L. trisulca, L. Still water; frequent in marshes bordering Lake Champlain.

SPIRODELA

S. polyrrhiza, Schleid. Duckweed. Stagnant pools; common.

XYRIDACEAE

XYRIS

X. Caroliniana, Walt. Wet borders of ponds; "Brattleboro," *Frost;* Newfane, *Grout.*

ERIOCAULEAE

ERIOCAULON

E. septangulare, Withering. Borders of ponds and lakes; frequent.

PONTEDERIACEAE

HETERANTHERA

H. graminea, Vahl. (H. dubia, MacM.) Ponds and streams; frequent.

PONTEDERIA

P. cordata, L. Pickerel Weed. Borders of ponds and slow streams; frequent.

JUNCACEAE. RUSH FAMILY

JUNCUS. Rush

J. alpinus, Villars, var. **insignis,** Fries. (J. Richardsonianus, Schult.) Knight's Island, *Pringle.*

J. articulatus, L. Peacham, *Blanchard;* Joe's Pond, W. Danville, *Jones;* Manchester, *Miss Day;* Pownal, *Eggleston.*

J. brachycephalus, Buch. (J. Canadensis, J. Gay. var. brachycephalus, Engelm.) Moist sandy soil. New Haven and Woodbury, *Brainerd;* Quechee Gulf and Pownal. *Eggleston.*

J. bufonius, L. Low ground; common.

J. Canadensis, J. Gay. Borders of ponds; common.

J. Canadensis, J. Gay. var. **brevicaudatus,** Engelm. (J. Canadensis, J. Gay, var. coarctatus, Engelm.) Moist places in mountains; common.

J. effusus, L. Moist meadows; common.

J. filiformis, L. Sandy shores of northern Lake Champlain and on mountain summits; occasional.

J. Greenii, Oakes and Tuckerm. Newfane, *M. A. Howe.*

J. marginatus, Rostk. Newfane, *M. A. Howe.*

J. nodosus, L. Wet meadows; common.

J. pelocarpus, E. Meyer. Shores of ponds; occasional.

J. tenuis, Willd. Fields; common.

J. trifidus, L. Summit of Mt. Mansfield, *Robbins;* Camel's Hump, *Tuckerman* and *Macrae.*

LUZULA. (JUNCOIDES)

L. campestris, DC. Dry woods and fields ; frequent.

L. spadicea, DC., var. **melanocarpa,** Meyer. (J. parviflorum, Coville.) Wet places at high altitudes. Mt. Mansfield, *Robbins;* Camel's Hump, *Tuckerman* and *Macrae;* Killington, *Sargent* and *Eggleston*; Pleiad Lake, Hancock, *Brainerd.*

L. spicata, Desvaux. Smuggler's Notch, *Pringle.* Nearly extinct.

L. vernalis, DC. Woods and banks ; frequent.

LILIACEAE. LILY FAMILY

ALLIUM. Onion

A. FISTULOSUM, L. Welch Onion. Manchester, *Miss Day.*

A. Schoenoprasum, L. Chives. Moist rocky shores of Connecticut River. Windsor, *Leland;* Hartland, *Eggleston.*

A. tricoccum, Ait. Wild Leek. Rich woods ; frequent.

ASPARAGUS

A. OFFICINALIS, L. Escaped from gardens ; occasional.

CLINTONIA

C. borealis, Raf. Cool moist woods ; common.

ERYTHRONIUM. Dog-tooth Violet

E. Americanum, Ker. Adder's Tongue. Rich copses and woodlands ; common.

HEMEROCALLIS. Day Lily

H. FULVA, L. Roadside escape from gardens ; occasional.

LILUM. Lily.

L. Canadense, L. Yellow Lily. Moist meadows ; common.

L. Philadelphicum, L. Red Lily. Sandy open woodlands ; common.

L. TIGRINUM, Ker. Tiger Lily. Roadside escape from gardens. Peacham, *Blanchard;* Rutland, *Eggleston;* Burlington, *Miss Brown.*

MAIANTHEMUM

M. Canadense, Desf. Woods ; common.

MEDEOLA

M. Virginiana, L. Indian Cucumber. Rich moist woods ; common.

OAKESIA. (UVULARIA)

O. sessilifolia, Watson. Moist woodlands ; common.

POLYGONATUM. Solomon's Seal

P. biflorum, Ell. Wooded hillsides ; common.

P. giganteum, Dietrich. (P. commutatum, Dietr.) Meadows and river banks. "Hartford," *Ward;* Manchester and Vernon, *Grout* ; Fairlee, *Jesup* and *Sargent* ; Pownal, *Eggleston* and *Andrews.*

SMILACINA. (VAGNERA) False Solomon's Seal

S. racemosa, Desf. Moist copses ; common.

S. stellata, Desf. Moist banks and meadows ; frequent.

S. trifolia, Desf. Cold sphagnum swamps ; occasional.

SMILAX. Green-brier

S. herbacea, L. River banks and moist thickets ; frequent.

STREPTOPUS. Twisted Stalk

S. amplexifolius, DC. Wet mountain woods ; frequent.

S. roseus, Michx. Cold damp woods ; common.

TOFIELDIA

T. glutinosa, Willd. Quechee Gulf, *Leland.* [Sumner's Falls, Plainfield, N. H., *Sargent.*]

TRILLIUM. Wake-robin

T. cernuum, L. Nodding Trillium. Moist woods ; occasional.

T. erectum, L. Purple Trillium. Rich woods ; common.

T. grandiflorum, Salisb. White Trillium. Rich moist woods of western Vermont ; common in the Champlain valley. Not known east of the Green Mountains.

T. undulatum, Willd. (T. erythrocarpum, Michx.) Painted Trillium. Cool moist woods ; frequent.

UVULARIA. Bellwort

U. grandiflora, Smith. Rich woods ; common.

U. perfoliata, L. West Rutland, rare, Pownal, abundant, *Eggleston.*

VERATRUM. False Hellebore

V. viride, Ait. Indian Poke. Wet meadows and swamps ; common.

ZYGADENUS

Z. elegans, Pursh. Bluffs of Lake Champlain, Ferrisburgh, *Brainerd.*

IRIDACEAE. IRIS FAMILY

IRIS

I. versicolor, L. Blue Flag. Wet meadows; common.

SISYRINCHIUM. Blue-eyed Grass

S. angustifolium, Mill. Moist meadows; common.

S. Atlanticum, Bicknell. Stratton, above 2000 feet, *Grout.*

ORCHIDACEAE. ORCHID FAMILY

APLECTRUM

A. hiemale, Nutt. (A. spicatum, B. S. P.) Rich woods; occasional.

ARETHUSA

A. bulbosa, L. Sphagnum bogs; occasional.

CALOPOGON. (LIMODORUM)

C. pulchellus, R. Br. (L. tuberosum, L.) Bogs; occasional.

CALYPSO

C. borealis, Salisb. (C. bulbosa, Oakes.) Cold cedar swamps of the northern counties; rare.

CORALLORHIZA. Coral-root

C. innata, R. Br. (C. Corallorhiza, Karst.) Swamps and damp woods; frequent.

C. multiflora, Nutt. Dry woods; occasional.

C. odontorhiza, Nutt. "Bellows Falls," *Carey;* Pease Mountain, *Pringle;* Pownal, *Eggleston.*

CYPRIPEDIUM. Lady's-slipper. Moccasin-flower

C. acaule, Ait. Stemless Lady's-slipper. Woods and swamps; frequent.

C. arietinum, R. Br. Ramshead. Rocky woods and swamps; local and rare.

C. parviflorum, Salisb. Smaller Yellow Lady's-slipper. Bogs and low woods; frequent.

C. pubescens, Willd. (C. hirsutum, Mill.) Larger Yellow Lady's-slipper. Rich moist woods; frequent.

C. spectabile, Salisb. (C. reginae, Walt.) Showy Lady's-slipper. Cold swamps; occasional.

GOODYERA. (PERAMIUM.) RATTLE-SNAKE PLANTAIN

G. pubescens, R. Br. Dry woods at low attitudes; occasional.

G. repens, R. Br. Hemlock woods, Abby Pond, Ripton, *Brainerd.*

G. repens, R. Br. var. **ophioides,** Fernald. Cold mossy spruce woods; frequent.

G. tesselata, Lodd. See Rhodora I: 6. 1899. Cold moist woods at high altitudes; occasional.

HABENARIA

H. blephariglottis, Torr. White Fringed Orchid. Bogs. "N. Troy," *Carey;* Smuggler's Notch, *Eggleston;* Burlington, *Torrey;* Johnson, *Grout.*

H. bracteata, R. Br. Damp woods and meadows; frequent.

H. dilatata, Gray. Cold bogs; frequent.

H. fimbriata, R. Br. (H. grandiflora, Torr.) Purple Fringed Orchid. Cool mountain woods and meadows; occasional. A form with white, fragrant flowers, Nebraska Notch, Underhill, *Eggleston.*

H. Hookeriana, A. Gray. (H. Hookeri, Torr.) Dry woods; occasional.

H. hyperborea, R. Br. Bogs and cold woods; frequent.

H. lacera, R. Br. Ragged Fringed Orchid. Moist ground. Rutland, Hubbardton, Pownal, *Eggleston;* Ferrisburgh, *E. Faxon.*

H. obtusata, Richardson. Cold mountain woods; occasional.

H. orbiculata, Torr. Cold rich woods; frequent.

H. psycodes, Gray. Purple Fringed Orchid. Wet meadows and bogs; frequent.

H. tridentata, Hook. (H. clavellata, Spring.) Bogs and wet borders of ponds; occasional.

H. virescens, Spreng. (H. flava, A. Gray.) Moist soil; local.

LIPARIS. TWAY-BLADE

L. liliifolia, Richard. Swamps. "Bellows Falls," *Carey;* "Windsor," *Leland;* Middlebury, *Brainerd.*

L. Loeselii, Richard. Moist banks; frequent.

LISTERA. TWAY-BLADE

L. convallarioides, Nutt. Cold mountain bogs and brooksides; rare.

L. cordata, R. Br. Sphagnum bogs and mossy mountain woods; frequent.

MICROSTYLIS. (ACHROANTHES)

M. monophyllos, Lindl. Swamps; rare.

M. ophioglossoides, Nutt. (A. unifolia, Raf.) Open woods; occasional.

ORCHIS

O. rotundifolia, Pursh. Cold cedar swamps. Monkton and Bristol, *Pringle.*

O. spectabilis, L. Showy Orchis. Rich, moist woods at lower altitudes; common.

POGONIA

P. ophioglossoides, Nutt. Bogs; frequent.

P. pendula, Lindl. (P. trianthophora, B. S. P.) Dry woodlands. Fair Haven, *Chandler* (Specimen in herbarium Bost. Soc. Nat. Hist.); Newfane, *Howe* and *Grout;* Westminster, *Blanchard.*

P. verticillata, Nutt. Colchester, *Robbins, Torrey;* Pownal, *Andrews.* (Specimen in Williams College herbarium)

SPIRANTHES. (GYROSTACHYS.) LADIES' TRESSES

S. cernua, Richard. Wet soil; common.

S. gracilis, Bigelow. Sandy woods and plains; occasional,

S. latifolia, Torr. (G. plantaginea, Britton.) Wet gravelly shores; occasional.

S. Romanzoffiana, Cham. Bogs and cold moist soil; occasional.

DICOTYLEDONS.

JUGLANDACEAE. WALNUT FAMILY

CARYA. (HICORIA)

C. alba, Nutt. (H. ovata, Britton.) Shellbark Hickory. Rich soil; frequent west of the Green Mountains; less so in the southern Connecticut valley and its tributaries.

C. amara, Nutt. (H. minima, Britton.) Bitternut Hickory. Moist soil; frequent, with range about as the preceding.

C. porcina, Nutt. (H. glabra, Britton.) Pignut. W. Castleton, Pownal, *Eggleston.* Marsh Hill, Ferrisburgh, *Brainerd.*

JUGLANS

J. cinerea, L. Butternut. Rocky hillsides; frequent.

MYRICACEAE

MYRICA.

M. asplenifolia, Endl. (Comptonia peregrina, Coulter.) Sweet Fern. Dry sterile soil ; common.

M. Gale, L. Sweet Gale. Swamps and borders of ponds ; frequent.

SALICACEAE. WILLOW FAMILY

POPULUS. Poplar

P. ALBA, L. White Poplar. Frequently spreading from the roots or escaped from cultivation.

P. balsamifera, L. Balm of Gilead. Balsam Poplar. Borders of streams and swamps ; frequent.

P. DILATATA, Ait. Lombardy Poplar. Frequent in cultivation and spreading from the root. Only staminate trees occur.

P. deltoides, Marsh. (P. monilifera, Ait.) Cottonwood. Borders of streams and lakes ; frequent in western Vermont and in the Connecticut valley as far north as Brattleboro.

P. grandidentata, Michx. Large-tooth Aspen. Rich woods ; frequent.

P. tremuloides, Michx. American Aspen. Woods ; common.

SALIX. Willow

S. ALBA, L. var. VITELLINA, Koch. White Willow. Frequent in cultivation and as an escape by banks of streams.

S. balsamifera, Barratt. Mt. Mansfield, *Pringle ;* Long Pond, Westmore, *E. Faxon ;* Elmore Mountain, *Grout.*

S. candida, Willd. Cold bogs ; rare.

S. cordata, Muhl. Low wet soil ; common.

S. discolor, Muhl. Wet soil ; common.

S. discolor, Muhl. var. **prinoides,** Anders. Johnson, *Grout.*

S. fluviatilis, Nutt. (S. longifolia, Muhl.) Shores of Lake Champlain and of the Connecticut River ; rare.

S. FRAGILIS, L. Crack Willow. Common in cultivation and as an escape by streams and ponds.

S. humilis, Marsh. Sandy barrens ; frequent.

S. lucida, Muhl. Shining Willow. Moist banks ; frequent.

S. myrtilloides, L. Peat bogs. Burlington, *Robbins ;* Bristol Bog, *Pringle ;* Rutland, *Ross.*

S. nigra, Marsh. Black Willow. Banks of streams and ponds ; common.

S. nigra, Marsh. var. **falcata,** Torr. Frequent, with the species.

S. petiolaris, Smith. Swamps and shores of Lake Champlain ; occasional.

S. phylicifolia, L. Lake of the Clouds, Mt. Mansfield, *Pringle.* Two forms occur here, the one broad leaved, the other narrow leaved ; the latter may be distinct.

S. PURPUREA, L. Formerly cultivated for basket rods, now occasional as an escape by water sides.

S. rostrata, Richardson. (S. Bebbiana, Sargent.) Borders of thickets ; common.

S. sericea, Marsh. In swamps and along streams ; occasional.

S. Uva-ursi, Pursh. Summit of Mt. Mansfield, *Robbins.*

S. discolor × humilis, Bebb. Johnson, *Grout.*

S. FRAGILIS × ALBA, Bebb. Johnson, *Grout.*

S. sericea × cordata, Bebb. Johnson, *Grout.*

CUPULIFERAE. OAK FAMILY

ALNUS. ALDER

A. incana, Willd. Borders of streams ; common.

A. serrulata, Willd. (A. rugosa, Koch.) Moist soil ; frequent.

A. viridis, DC. (A. Alnobetula, Koch.) Higher mountain summits ; common ; rocky shores Connecticut River, occasional. Burlington Bay, *Mrs. Flynn.*

A. serrulata × incana. Burlington Bay, *Jones* and *Eggleston.*

BETULA. BIRCH

B. lenta, L. Sweet or Black Birch. Rich woodlands ; frequent in western Vermont and in the southern Connecticut valley.

B. lutea, Michx. f. Yellow Birch. Rich cool soils ; frequent, especially on mountain sides.

B. papyrifera, Marshall. Paper or Canoe Birch. Common.

B. papyrifera, Marshall. var. **minor,** Tuckerman. Summit Mt. Mansfield, *Eggleston.*

B. populifolia, Ait. White Birch. Frequent in the Champlain valley, less so in southern Vermont.

CARPINUS

C. Caroliniana, Walter. Blue Beech. Near streams ; common.

CASTANEA

C. **sativa**, Mill., var. **Americana**, Watson. (C. dentata, Borkh.) Chestnut. Frequent in the lower Connecticut valley and in southwestern Vermont; a few trees at Burlington.

CORYLUS. Hazelnut

C. **Americana**, Walt. Thickets; frequent.

C. **rostrata**, Ait. Dry thickets; common.

FAGUS

F. **ferruginea**, Ait. (F. Americana, Sweet.) Beech. Common.

OSTRYA

O. **Virginica**, Willd. (O. Virginiana, Willd.) Hop Hornbeam. Common.

QUERCUS. Oak

Q. **alba**, L. White Oak. Common west of the Green Mountains, less so in the southern Connecticut valley.

Q. **bicolor**, Willd. (Q. platanoides, Sudw.) Swamp White Oak. Low moist soil; frequent in the Champlain valley, especially near the lake.

Q. **velutina**, Lam. (Q. cocinea, Wang. var. tinctoria, Gray.) Yellow Oak. Dry light soil; frequent in western Vermont and in the southern Connecticut valley.

Q. **ilicifolia**, Wang. (Q. nana, Sargent.) Dry sandy soil. "Bellows Falls," *Carey;* Brattleboro, *Grout.*

Q. **macrocarpa**, Michx. Bur Oak. Rich soil; occasional in the Champlain valley, more common in Addison county.

Q. **Muhlenbergii**, Engelm. (Q. acuminata, Sargent.) Gardiner's Island, Ferrisburgh, *Pringle.*

Q. **prinoides**, Willd. Dry hillsides. "Pownal," *Robbins;* North Pownal, *Eggleston;* Snake Mountain, *Brainerd.*

Q. **Prinus**, L. Chestnut Oak. Dry rocky hillsides of western Vermont; frequent from Charlotte, *Pringle*, through Addison county, *Brainerd*, and Rutland to Pownal, *Eggleston.*

Q. **rubra**, L. Red Oak. Common.

Q. **macrocarpa × alba.** Charlotte, *Pringle.*

Q. **Prinus × alba.** Monkton, *Pringle.*

URTICACEAE. NETTLE FAMILY

BŒHMERIA

B. cylindrica, Willd. Moist shady ground ; common.

CANNABIS

C. SATIVA, L. Hemp. Waste places ; occasional.

CELTIS

C. occidentalis, L. Hackberry. River banks and intervals. Burlington, *Robbins, Collins;* Highgate Springs and Norwich, *Jesup;* Monkton, *Horsford;* New Haven and Cornwall, *Brainerd;* Windsor, *Eggleston.*

HUMULUS

H. Lupulus, L. Hop. Occasional by waysides as an escape from cultivation.

LAPORTEA

L. Canadensis, Gaudichaud. (Utricastrum divaricatum, Kuntze.) Moist rich woods ; common.

MORUS

M. ALBA, L. White Mulberry. Often planted and occasionally escaped. Middlebury, *Brainerd;* Burlington, *Mrs. Flynn.*

M. rubra, L. Red Mulberry. Rich woods. Pownal, *Oakes;* North Pownal, *Eggleston.*

PARIETARIA

P. Pennsylvanica, Muhl. Rocky banks and cliffs ; occasional in western Vermont.

PILEA. (ADICEA)

P. pumila, Gray. Cool moist woods ; common.

ULMUS

U. Americana, L. American or White Elm. Moist soil ; common.

U. fulva, Michx. Slippery Elm. Rich rocky woods ; frequent.

U. racemosa, Thomas. Cork Elm. Limestone soils, western Vermont ; rare.

URTICA

U. gracilis, Ait. Fence rows and moist ground ; common.

U. URENS, L. Waste places. Barnet, *Blanchard;* Royalton, *Ward.*

LORANTHACEAE

ARCEUTHOBIUM. (RAZOUMOFSKYA)

A. **pusillum**, Peck. Dwarf Mistletoe. Occasional as a parasite on spruces and tamarack. Rhodora 2 : 1. Jan. 1900.

SANTALACEAE

COMANDRA

C. **livida**, Richardson. Summit of Mt. Mansfield under stunted balsams, *Pringle.*

C. **umbellata**, Nutt. Dry thickets ; frequent.

ARISTOLOCHIACEAE

ASARUM

A. **Canadense**, L. Wild Ginger. Rich rocky woods ; common.

POLYGONACEAE. BUCKWHEAT FAMILY

FAGOPYRUM

F. ESCULENTUM, Moench. (F. Fagopyrum, Karst.) Buckwheat. Persisting from cultivation.

F. TATARICUM, Gaertn. Indian Wheat. Persisting in cultivated fields.

POLYGONUM

P. **acre**, HBK. var. **leptostachyum**, Meisn. Water Smartweed. Wet meadows ; occasional.

P. **amphibium**, L. Margins of ponds and slow streams ; occasional.

P. **arifolium**, L. Low grounds ; frequent.

P. **aviculare**, L. Knotgrass. Common in door yards and roadsides. A broad leaved form is *P. littorale*, Link.

P. **Careyi**, Olney. Brattleboro, *Frost* ; Newfane and Brattleboro, *Grout.*

P. **cilinode**, Michx. Rocky copses ; frequent.

P. **Convolvulus**, L. Tilled fields ; common.

P. **Douglassii**, Greene. Dry soils ; occasional in Champlain valley.

P. **dumetorum**, L. var. **scandens**, Gray. (P. scandens, L.) Moist thickets ; frequent.

P. **erectum**, L. Rutland, Bennington, Pownal, *Eggleston;* Middlebury, *Brainerd;* Burlington, *Mrs. Flynn.*

P. **Hartwrightii**, Gray. Marshes; occasional.

P. **Hydropiper**, L. Smartweed. Moist places; common.

P. **hydropiperoides**, Michx. Wet places and shallow water; occasional.

P. **lapathifolium**, L. var. **incarnatum**, Watson. (P. incarnatum, Ell.) Alluvial fields; frequent in the Champlain valley.

P. **Muhlenbergii**, Watson. (P. emersum, Britton.) Muddy or dry places; frequent.

P. ORIENTALE, L. Prince's Feather. Persisting about gardens.

P. **Pennsylvanicum**, L. Moist soil; common.

P. PERSICARIA, L. Lady's Thumb. Waste places; a common weed.

P. **ramosissimum**, Michx. Frequent about dwellings.

P. **sagittatum**, L. Tear-thumb. Low ground; common.

P. **Virginianum**, L. Moist thickets; occasional.

P. **viviparum**, L. Mt. Mansfield, *Pringle.*

RUMEX. Dock

R. ACETOSA, L. Charlotte, *Pringle;* Burlington, *Jones.*

R. ACETOSELLA, L. Sheep Sorrel. Fields; common.

R. **Britannica**, L. Wet places; frequent.

R. CRISPUS, L. Curled Dock. Fields and waste places; common.

R. OBTUSIFOLIUS, L. Bitter Dock. Fields and waste places; common.

R. PATIENTIA, L. Occasional; apparently becoming more common.

R. **verticillatus**, L. Swamps; common in the western counties.

CHENOPODIACEAE. GOOSEFOOT FAMILY

ATRIPLEX

A. **patulum**, L. Waste places, especially along railways; naturalized; occasional.

CHENOPODIUM. Pigweed

C. ALBUM, L. Pigweed. Fields; common.

C. AMBROSIOIDES, L. Adventive. Charlotte, *Pringle.*

C. BOTRYS, L. Waste places; becoming common.

C. **capitatum**, Watson. (Blitum capitatum, L.) Dry rich ground; apparently indigenous in places, occasionally introduced.

C. GLAUCUM, L. Railroad yards, Burlington, Bennington and Ferrisburgh.

C. **hybridum,** L. Shady ledges and waste places ; frequent.

C. URBICUM, L. Lumber yards. Burlington, *Howe.*

KOCHIA

K. SCOPARIA, Schrad. Adventive in Pringle's door yard, East Charlotte.

AMARANTACEAE

ACNIDA

A. **tuberculata,** Moq. var. **subnuda,** Watson. (A. tamariscina var. tuberculata, Uline and Bray.) Shady banks of slow streams or bays, Champlain valley ; frequent.

AMARANTUS

A. **blitoides,** Watson. Yards and waste places ; occasional, becoming more common.

A. **graecizans,** L. (A. albus, L.) Waste places ; a recently introduced weed; railroad yards and gardens. Burlington, Charlotte, *Pringle ;* Bennington, *Eggleston.*

A. HYBRIDUS, L. (A. hypochondriacus, L.) Old garden, Peacham, *Blanchard.*

A. HYBRIDUS, L. var. PANICULATUS, Uline and Bray. (A. paniculatus, L.) Shelburne, garden weed, *Pringle ;* West Windsor, *Blanchard.*

A. RETROFLEXUS, L. Rich cultivated ground ; common.

PHYTOLACCACEAE. POKEWEED FAMILY

PHYTOLACCA

P. **decandra,** L. Pokeweed. Pastures and fields ; occasional.

FICOIDEAE

MOLLUGO

M. VERTICILLATA, L. Carpet Weed. Sandy banks and waste places; frequent

PORTULACACEAE. PURSLANE FAMILY

CLAYTONIA

C **Caroliniana,** Michx. Spring Beauty. Rich, open woods ; common.

C. **Virginica,** L. Intervale in Colchester, *Torrey, Jones ;* New Haven, *Pri n gle.*

PORTULACA

P. OLERACEA, L. Purslane. Garden weed ; common.

CARYOPHYLLACEAE. PINK FAMILY

AGROSTEMMA

A. GITHAGO, L. (Lychnis Githago, Lam.) Corn Cockle. Fields ; occasional.

ARENARIA. SANDWORT

A. **Groenlandica,** Spreng. Common on rocks at summits of Mt. Mansfield and Camel's Hump.

A. **lateriflora,** L. (Moehringia lateriflora, Fenzl.) Moist banks and shores ; occasional.

A. **macrophylla,** Hook. Abundant on limestone ledges above Proctorsville, *Eggleston.*

A. SERPYLLIFOLIA, L. Dry rocky places ; frequent.

A. **stricta,** Michx. (A. Michauxii, Hook, f.) Cliffs and headlands ; occasional.

A. **verna,** L. var. **hirta,** Watson. Smuggler's Notch, *Pringle.*

CERASTIUM. MOUSE-EAR CHICKWEED

C. **arvense,** L. Dry rocky places ; occasional.

C. **nutans,** Raf. (C. longipedunculatum, Muhl.) Thin soil on ledges, west of the Green Mountains ; occasional.

C. VULGATUM, L. Fields ; common.

DIANTHUS. PINK

D. ARMERIA, L. Fields ; Castleton, *Ross.*

D. BARBATUS, L. Sweet William. Garden escape. Rutland, *Eggleston* ; Stowe, *Wild ;* Manchester, *Miss Day.*

D. DELTOIDES, L. Roadsides and cemeteries ; occasional.

LYCHNIS

L. ALBA, Mill. (L. vespertina, Sibth.) Weed in fields; Peacham, *Blanchard ;* Middlebury, *Brainerd ;* Clarendon Springs and Rutland, *Eggleston.*

L. CHALCEDONICA, L. Peacham, *Blanchard ;* Barnet, *Jesup* and *Sargent.*

L. CORONARIA, L. Rocky pastures ; abundant on Round Mountain, Shrewsbury, *Eggleston ;* Jamaica, *Bates.*

L. DIOICA, L. (L. diurna, Sibth.) Brattleboro, *Bates* and *Jones.*

SAGINA

S. decumbens, Torr. & Gray. With *Spergularia rubra*, roadside below Brattleboro, *Grout.*

S. procumbens, L. Springy places. "Brattleboro," *Frost;* Peacham, *Blanchard;* Newbury, *Jesup* and *Sargent;* Walden and Cabot, *Burbank;* Randolph Center, *Bates.*

SAPONARIA

S. OFFICINALIS, L. Bouncing Bet. Waste places; common.

S. VACCARIA, L. (Vaccaria vaccaria, Britt.) Vernon, *Grout;* Westmore, *J. R. Churchill;* Pownal, *Eggleston.*

SILENE

S. antirrhina, L. Catchfly. Dry soil; frequent.

S. CUCUBALUS, Wibel. (S. vulgaris, Garcke.) Bladder Campion. Roadsides and fields; occasional.

S. NOCTIFLORA, L. Fields and waste places; occasional.

SPERGULA

S. ARVENSIS, L. Corn Spurrey. Fields; occasional.

SPERGULARIA. (BUDA, TISSA)

S. rubra, Presl. Royalton, *Ward;* Brattleboro, *Grout;* Mt. Holly, *Eggleston.*

STELLARIA. (ALSINE.) CHICKWEED

S. borealis, Bigel. Cold wet places in the mountains; frequent.

S. GRAMINEA, L. Roadsides and moist grass lands; frequent.

S. longifolia, Muhl. Damp intervales and thickets; occasional.

S. MEDIA, Smith. In lawns and waste places; abundant.

S. uliginosa, Murr. About cold springs. Rochester, Chittenden, *Eggleston;* Vernon, *Grout.*

NYMPHAEACEAE. WATER LILY FAMILY

BRASENIA. WATER SHIELD

B. peltata, Pursh. (B. purpurea, Casp.) Ponds; occasional.

NUPHAR. (NYMPHÆA.) YELLOW POND LILY

N. advena, Ait. f. Common in ponds and slow streams.

N. advena, Ait. f. var. **minus,** Morong. (Nymphæa rubrodisca, Greene.) Still water; occasional.

N. minimum, Smith. (N. Kalmianum, Ait.) Ponds and slow streams; frequent.

NYMPHÆA. (CASTALIA.) WHITE WATER LILY

N. odorata, Ait. Ponds and slow streams; common.

N. odorata, Ait. var. **minor**, Sims. With the species; frequent.

N. reniformis, DC. (N. tuberosa, Paine.) Lake Champlain and tributaries; common.

ILLECEBRACEAE.[1]

ANYCHIA

A. capillacea, DC. (A. Canadensis, B. S. P.) Dry open woodlands. Pownal, *Robbins*, *Eggleston*; West Rutland, *Eggleston*.

CERATOPHYLLACEAE

CERATOPHYLLUM

C. demersum, L. Slow streams and ponds; frequent.

MAGNOLIACEAE. MAGNOLIA FAMILY

LIRIODENDRON

L. Tulipifera, L. Tulip-tree. "Hoosic valley," *Mrs. Carr;* Pownal, *Eggleston*.

RANUNCULACEAE. CROWFOOT FAMILY

ACTÆA. COHOSH

A. alba, Bigel. White Baneberry. Rich woods; common.

A. spicata, L. var. **rubra**, Ait. (A. rubra, Willd.) Red Baneberry. Rich woods; common.

ANEMONE

A. Canadensis, L. (A. Pennsylvanica, L.) Stony banks; common along Lake Champlain and its tributaries.

A. cylindrica, Gray. Dry woods and fields; frequent.

A. multifida, Poir. Colchester and Winooski Falls, *Robbins;* Highgate Springs, *Jesup*.

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1 The *Illecebraceae* should come after the *Carophyllaceae* on the preceding page.

A. quinquefolia, L. (A. nemorosa, L. var. quinquefolia, Gray.) Wind Flower. Woodlands; common.

A. riparia, Fernald. (A. Virginiana, var. alba, Wood.) (Rhodora 1:51. 1899.) Gravelly and rocky banks; frequent in western and northern Vermont.

A. Virginiana, L. Woods and meadows; common.

ANEMONELLA. (SYNDESMON)

A. thalictroides, Spach. Rue Anemone. North Pownal, common on rich wooded hills, *Eggleston.*

AQUILEGIA. COLUMBINE

A. Canadensis, L. Rocky places; common.

A. VULGARIS, L. Common in gardens and occasional as a wayside escape.

CALTHA. MARSH MARIGOLD

C. palustris, L. Wet meadows and swamps; common.

CLEMATIS

C. verticillaris, DC. (Atragene Americana, Sims.) Rocky woods; occasional.

C. Virginiana, L. Virgin's Bower. River banks and moist thickets; common.

COPTIS

C. trifolia, Salisb. Goldthread. Wet woods; common.

HEPATICA

H. acutiloba, DC. (H. acuta, Britton) Woods; common.

H. triloba, Chaix. (H. Hepatica, Karst.) Warm open woods; frequent.

HYDRASTIS

H. Canadensis, L. Golden Seal. Shelburne, *Horsford.*

RANUNCULUS. BUTTERCUP

R. abortivus, L. Shady banks; common.

R. abortivus, L. var. **eucyclus,** Fernald. (Rhodora 1:52. 1899.) Cool woods. North Pownal, *Eggleston.*

R. ACRIS, L. Everywhere common as a weed in grass lands.

R. ACRIS, L. var. STEVENI, Andrez. (Rhodora 1:227. 1899.) Common.

R. aquatilis, L. var. **trichophyllus,** Gray. (Batrachium trichophyllum, Bosch.) Ponds and slow streams; frequent.

R. BULBOSUS L. Sparingly introduced in fields ; Whiting, *Brainerd ;* Thetford, *Blanchard ;* Burlington, *Collins ;* Pownal, *Eggleston.*

R. **circinatus,** Sibth. (Batrachium divaricatum, Wimm.) Ponds and slow streams ; rare.

R. **fascicularis,** Muhl. "Burlington," *Torrey ;* "Norwich," *Blanchard ;* "Brattleboro," *Frost ;* Snake Mountain, *Brainerd.*

R. **Flammula,** L. var. **reptans,** E. Meyer. (R. reptans, L.) Sandy shores ; frequent.

R. **hispidus,** Michx. Abundant on dry hills. North Pownal, *Eggleston.*

R. **multifidus,** Pursh. (R. delphinifolius, Torr.) Still water and muddy banks ; occasional.

R. **Pennsylvanicus,** L. f. Wet places ; frequent.

R. **recurvatus,** Poir. Moist woods and swamps ; frequent.

R. **repens,** L. Campus, Burlington, introduced with grass seed, *Jones.*

R. **septentrionalis,** Poir. Wet places ; common.

THALICTRUM. MEADOW RUE

T. **dioicum,** L. Rocky woodlands ; common.

T. **polygamum,** Muhl. Moist meadows ; common.

BERBERIDACEAE. BARBERRY FAMILY

BERBERIS

B, VULGARIS, L. Barberry. Common in cultivation and a frequent escape. Especially abundant along streams in Ira, *Eggleston.*

CAULOPHYLLUM

C. **thalictroides,** Michx. Blue Cohosh. Rich woods ; common.

PODOPHYLLUM

P. **peltatum,** L. Mandrake. "Castleton," *Branch ;* Middlebury, *Brainerd ;* common at N. Pownal, *Eggleston ;* also occasional as a garden escape.

MENISPERMACEAE. MOONSEED FAMILY

MENISPERMUM

M. **Canadense,** L. Moonseed. Moist banks and thickets ; occasional.

LAURACEAE

LINDERA. (BENZOIN)

L. Benzoin, Blume. Spicebush. Damp woods; rare.

SASSAFRAS

S. officinale, Nees. (S. Sassafras, Karst.) Pownal, *Robbins*, *Eggleston;* Hartland and Brattleboro, *Bates;* Vernon, *Grout.*

PAPAVERACEAE. POPPY FAMILY

CHELIDONIUM

C. MAJUS, L. Celandine. Waste places; frequent.

SANGUINARIA

S. Canadensis, L. Blood-root. Borders of rich woods; common.

FUMARIACEAE

ADLUMIA

A. chirrhosa, Raf. (A. fungosa, Greene.) Mountain Fringe. Rich, rocky woods; occasional.

CORYDALIS. (CAPNOIDES)

C. aurea, Willd. Rocky banks of western Vermont; rare. Norwich, *Jesup*, probably introduced.

C. glauca, Pursh. (C. sempervirens, Borck.) Rocky woodlands; frequent.

DICENTRA. (BICUCULLA)

D. Canadensis, DC. Squirrel Corn. Rich woods; frequent.

D. Cucullaria, DC. Dutchman's Breeches. Rich wooded hillsides; frequent.

FUMARIA

F. OFFICINALIS, L. Fumitory. Occasionally persistent in old gardens.

CRUCIFERAE. MUSTARD FAMILY

ARABIS. Rock Cress

A. Canadensis, L. Shady ledges; occasional. "Winooski Falls," *Torrey;* Shoreham and Weybridge, *Brainerd;* Pownal and Twin Mountain, W. Rutland, *Eggleston.*

A. confinis, Watson. (A. brachycarpa, Britton) Dry, rocky banks and cliffs ; occasional.

A. hirsuta, Scop. Rocky places ; frequent.

A. laevigata, Poir. Rocky places ; occasional,

A. lyrata, L. Mt. Equinox, Manchester, *Miss Day;* N. Pownal, *Eggleston.*

A. perfoliata, Lam. (A. glabra, Bernh.) Occasional, apparently becoming more common as an introduced weed in fields.

BARBAREA. WINTER CRESS

B. stricta, Andrz. Wet places ; frequent.

B. vulgaris, R. Br. (B. Barbarea, MacM.) (Including former variety *arcuata.*) Wet places ; common.

BERTEROA

B. INCANA, DC. A weed in lawns. Burlington, *Miss Towle;* roadside, Colchester and Essex Junction, *Mrs. Flynn.*

BRASSICA

B. CAMPESTRIS, L. Wild Turnip. Fields ; frequent.

B. JUNCEA, Cosson. Indian Mustard. Fields and waste places ; occasional

B. NIGRA Koch. Black Mustard. Waste places and fields ; frequent.

B. SINAPISTRUM, Boiss. (B. arvensis, B. S. P.) Charlock. Fields ; common.

BRAYA

B. humilis, Robinson. (Sisymbrium humile, Meyer.) Willoughby Mountain, *H. Mann.*

CAMELINA. FALSE FLAX

C. MICROCARPA, Andrz. (C. sativa of Gray Manual in part.) Weed in fields ; occasional. Burlington, *Jones.* The plant recorded as *C. sativa* by our earlier botanists, e. g. "Ferrisburgh," *Robbins*, "Bellows Falls," *Carey*, was probably *C. microcarpa.*

CAPSELLA. (BURSA)

C. BURSA-PASTORIS Moench. Shepherd's Purse. Waste places ; common.

CARDAMINE

C. parviflora, L. (C. hirsuta, L. var. sylvatica, Gaud.) Dry rocky woods ; occasional.

C. Pennsylvanica, Muhl. (C. hirsuta of Gray Manual in part.) Cold wet woods; common. A form with more spreading pods, *C. flexuosa*, occurs in the mountains.

C. pratensis, L. Cold wet meadows. "Whiting and Alburgh," *Chandler;* "St. Albans," *Robbins;* Middlebury, *Brainerd;* W. Rutland, *Mrs. Flynn;* Ira, *Eggleston.*

C. rhomboidea, DC. (C. bulbosa, B. S. P.) Cold, wet meadows. "Castleton," *Robbins;* Middlebury, *Brainerd;* Rutland and Ira, *Eggleston;* W. Rutland, *Mrs. Flynn.*

DENTARIA. Pepper-root

D. diphylla, L. Rich, moist woods; common.

D. laciniata, Muhl. Rich woods. "Castleton," *Robbins;* Shelburne, *Pringle;* Colchester, *Torrey;* Gardiner's Island, *Horsford;* Proctor, *Ross;* S. Hero, *Brainerd.*

D. maxima, Nutt. Shelburne, *Pringle;* Burlington, *Perkins;* Norwich, *Eggleston.*

DRABA

D. incana, L. Willoughby Mountain, *Tuckerman;* Smuggler's Notch, *Pringle.*

D. incana, L. var. **arabisans,** Watson. Mountain cliffs and headlands of Lake Champlain; occasional.

ERYSIMUM

E. cheiranthoides, L. A weed in fields; occasional, but apparently increasing.

HESPERIS

H. matronalis, L. Rocket. Middlebury, *Brainerd;* Monkton, *Eggleston.*

LEPIDIUM. Peppergrass

L. apetalum, Willd. (L. intermedium, Gray.) Dry soil, especially along railroads; common.

L. campestre, Br. Brattleboro, *Bates;* Vergennes and Burlington, *Jones.*

L. Virginicum, L. Dry soil, especially along railroads; frequent.

NASTURTIUM. (RORIPA.) Water Cress

N. Armoracia, Fries. Horseradish. Moist places about dwellings; frequent.

N. lacustre, Gray. (R. Americana, Britton.) Marshy borders of inlets of Lake Champlain; occasional.

N. officinale, R. Br. (R. Nasturtium, Rusby.) Water Cress. Cool running waters, Rutland, Bennington, *Eggleston;* Charlotte, *Pringle;* Randolph, *Bates.*

N. sylvestre, R. Br. Yellow Cress. Alluvial meadows of the Connecticut River; frequent. "A persistent weed in intervals at Westminster, although it rarely, if ever, produces viable seed." *W. H. Blanchard.*

N. terrestre, R. Br. (N. palustre, DC.) Dry soil. Ripton, *Brainerd.*

N. terrestre, R. Br. var. **hispidum,** Fisch. and Mey. (R. hispida, Britton.) Wet places; frequent.

RAPHANUS

R. Raphanistrum, L. Radish. "South Hero," *Robbins;* Windsor, Hartland, *Eggleston;* Westminster, *Blanchard.*

SISYMBRIUM

S. altissimum, L. Fort Ethan Allen, *Mrs. Flynn;* Railroad, Middlebury, *Brainerd.*

S. officinale, Scop. Hedge Mustard. Common in waste places.

SUBULARIA

S. aquatica, L. Abundant in South Pond, Marlboro, *Grout.*

THLASPI

T. arvense, L. Penny Cress. Waste places; occasional.

CAPPARIDACEAE. CAPER FAMILY

POLANISIA

P. graveolens, Raf. Sandy shores of Lake Champlain; common.

SARRACENIACEAE. PITCHER PLANT FAMILY

SARRACENIA

S. purpurea, L. Pitcher-plant. Sphagnum bogs; frequent.

DROSERACEAE. SUNDEW FAMILY

DROSERA. Sundew

D. intermedia, Hayne. (D. intermedia, Hayne, var. Americana, DC.) Bogs. Fort Ethan Allen Pond, *Pringle;* Waterman's Pond, Thetford, *Blanchard.* Ponds of Windham County.

D. rotundifolia, L. Bogs and wet banks; frequent.

CRASSULACEAE. ORPINE FAMILY

PENTHORUM

P. sedoides, L. Ditches and swamps ; frequent.

SEDUM. Stonecrop

S. ACRE, L. On rocks ; occasional.

S. TELEPHIUM, L. Live-forever. Fields and roadsides ; common.

SAXIFRAGACEAE. SAXIFRAGE FAMILY

CHRYSOSPLENIUM

C. Americanum, Schwein. Wet shady places ; common.

MITELLA. Mitrewort

M. diphylla, L. Rich woods ; common.

M. nuda, L. Deep moist woods, in moss ; frequent.

PARNASSIA

P. Caroliniana, Michx. Grass-of-Parnassus. Wet banks and meadows ; common in Bennington county, occasional elsewhere.

RIBES

R. Cynosbati, L. Wild Gooseberry. Rocky woods ; common.

R. floridum, L'Her. Black Currant. Moist rich woods ; frequent.

R. lacustre, Poir. Cold swamps and mountain woods ; frequent.

R. oxyacanthoides, L. Cold swamps ; frequent.

R. prostratum, L'Her. Fetid Currant. Cold banks and mountain woods ; frequent.

R. rubrum, L. var. **subglandulosum**, Maxim. Red Currant. Cold swamps and mountain woods ; occasional.

SAXIFRAGA. Saxifrage

S. aizoides, L. Yellow Mountain Saxifrage. Moist cliffs, Willoughby Mountain, *A. Wood ;* Smuggler's Notch, *Pringle.*

S. Aizoon, Jacq. Mountain Saxifrage. Willoughby Mountain, Smuggler's Notch, Hazen's Notch, Montgomery, *Pringle.*

S. oppositifolia, L. Willoughby Mountain, *A. Wood ;* Smuggler's Notch, *Pringle.*

S. Pennsylvanica, L. Swamp Saxifrage. Bogs; common.

S. Virginiensis, Michx. Early Saxifrage. Exposed rocks and dry hillsides; common.

TIARELLA

T. cordifolia, L. False Mitrewort. Rich moist woods; common.

HAMAMELIDEAE

HAMAMELIS

H. Virginiana, L. Witch Hazel. Low woods; common.

PLATANACEAE

PLATANUS

P. occidentalis, L. Sycamore. Alluvial banks; occasional.

ROSACEAE. ROSE FAMILY

AGRIMONIA.[1] AGRIMONY

A. striata, Michx. (A. Brittoniana, Bicknell. A. Eupatoria, American authors in part.) Thickets and roadsides especially in mountain towns; frequent.

A. gryposepala, Wallr. (A. hirsuta, Bicknell. A. Eupatoria, American authors in part.) Woods and thickets; frequent.

AMELANCHIER.[2] SERVICE BERRY

A. Canadensis, Torr. & Gray. Shad Bush. Woods; common.

A. Canadensis, Torr. & Gray, var. (?) **oblongifolia,** Torr. & Gray. (A. Botryapium, DC.) Cold swamps; frequent.

A. Canadensis, Torr. & Gray, var. **rotundifolia,** Torr. & Gray. (A. rotundifolia, Roem.) Rocky shores of Connecticut and Champlain valleys; occasional.

A. oligocarpa, Roem. Summits of the higher mountains; occasional.

A. spicata, Dec. Dry rocky woods; frequent.

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1 See Robinson, B. L, The Nomenclature of our New England Agrimonies. Rhodora. December, 1900.

2 Several other distinct forms of *Amelanchier*, perhaps good species, occur in the State and are awaiting critical study.

CRATÆGUS. Hawthorn

C. coccinea, L. Scarlet Thorn. The plants of Vermont which have heretofore passed under this name are apparently of six or more distinct species. They are being carefully studied by Professor C. S. Sargent who will doubtless soon report his conclusions.

C. Crus-galli, L. Cockspur Thorn. Ferrisburgh, *Horsford;* Mt. Independence, *Eggleston;* Gardiner's Island, *C. E. Pinney;* Chimney Point, *Brainerd.*

C. macracantha, Lodd. (C. coccinea, L. var. macracantha, Dudley.) Longspine Thorn. Moist thickets and rich hillsides; common.

C. Oxyacantha, L. English Hawthorn. Occasionally escaped from cultivation. "Peacham," *Blanchard;* Burlington, *Jones;* Knight's Island, *Brainerd.*

C. pruinosa, Wend. Thickets, waysides and pastures; frequent. Fruit very distinct, glaucous, deep red, ripening late.

C. punctata, Jacq. Dotted Thorn. Common.

C. rotundifolia, Borck. Old pastures and waysides; occasional.

DALIBARDA

D. repens, L. Cool moist woods; frequent.

FRAGARIA. Strawberry

F. Americana, Britton. Woods; common.

F. vesca, L. Door-yard, Middlebury, *Brainerd.*

F. Virginiana, Mill. Fields; common.

GEUM. Avens

G. Canadense, Jacq. (G. album, Gmelin.) Borders of woods; common.

G. macrophyllum, Willd. Moist open mountain woods; common above 1500 feet altitude.

G. rivale, L. Purple Avens. Wet meadows and bogs; common.

G. strictum, Ait. Moist meadows; common.

C. Virginianum, L. Middlebury, *Brainerd;* Burlington, *Mrs. Flynn.*

POTENTILLA. Cinquefoil

P. Anserina, L. Common on beaches of Lake Champlain. Royalton, *Ward;* Rutland, Sumner's Falls, *Eggleston.*

P. argentea, L. Silverweed. Dry barren fields; common.

P. arguta, Pursh. Rocky hills; occasional.

P. fruticosa, L. Shrubby Cinquefoil. Swamps and moist cliffs. Smuggler's Notch; Lake Willoughby. Troublesome as a pasture weed in southwestern Vermont.

P. Monspeliensis, L. (P. Norvegica, L.) Dry soil; frequent.

P. palustris, Scop. (Comarum palustre, L.) Marsh Cinquefoil. Cool bogs; frequent.

P. RECTA, L. Brattleboro, *Bates;* Rutland, *Eggleston.*

P. simplex, Michx.[1] (P. Canadensis of American authors in part.) Dry soil; common.

P. tridentata, Ait. Summits of cliffs and mountains; occasional, e. g. Mt. Mansfield, Camel's Hump, Snake Mountain, Pownal.

POTERIUM. (SANGUISORBA.) BURNET

P. Canadense, Benth. and Hook. Brattleboro, *Frost;* abundant on the banks of the West River, *Grout.*

P. SANGUISORBA, L. Roadside, Charlotte Center, *Pringle.*

PRUNUS. PLUM. CHERRY

P. Americana, Marshall. var. **nigra,** Waugh. (P. nigra, Ait.) Canada Plum. Woods and fencerows; frequent.

P. AVIUM, L. Mazzard Cherry. Manchester, *Miss Day.*

P. cuneata, Raf. Sand banks of lake shore, Burlington, *Pringle.* Frequent on the sand plains, South Burlington, *Howe.*

P. Pennsylvanica, L. f. Wild Red Cherry. Roadside thickets; common.

P. pumila, L. Sand Cherry. Rocky or sandy shores of the Connecticut and Champlain valleys; occasional.

P. serotina, Ehrh. Black Cherry. Woodlands; common.

P. Virginiana, L. Choke Cherry. Fencerows, woods and banks; common.

PYRUS

P. Americana, DC. (Sorbus Americana, Marsh.) American Mountain Ash. Swamps and mountain woods; frequent.

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1 Just as this is going to press. a letter is received from M. L. Fernald, stating that "*Potentilla simplex*, Michx. is the common sprawling species of New England, while *P. Canadensis* is a low, hardly repent, canescent species which hardly reaches southern Maine and New Hampshire." It was not possible to re-examine Vermont specimens other than those in the herbarium of the University of Vermont. All of those proved to be *P. simplex* as above defined, and the name *P. Canadensis* is therefore omitted from the list.

P. AUCUPARIA, Gaert. European Mountain Ash. Peacham, *Blanchard;* frequent about Burlington, *Jones.*

P. **arbutifolia,** L. f. var. **melanocarpa,** Hook. (Aronia nigra, Britton.) Choke-berry. Swamps and damp thickets ; common.

P. MALUS, L. (Malus Malus, Britton.) Apple. Fencerows and roadsides ; frequent.

P. **sambucifolia,** Cham. and Schlecht. (Sorbus sambucifolia, Roem.) Elder-leaf Mountain Ash. Mt. Mansfield, Willoughby Mountain, *Pringle.*

ROSA. ROSE

R. **acicularis,** Lindl. Snake Mountain and Burlington, *Brainerd;* Manchester, *Miss Day.*

R. **blanda,** Ait. Roadsides and ledges ; frequent.

R. **Carolina,** L. Borders of swamps and streams ; common.

R. CINNAMOMEA, L. Cinnamon Rose. Roadsides and about old gardens ; frequent.

R. **humilis,** Marsh. Dry rocky slopes ; common.

R. **lucida,** Ehrh. (R. humilis, Marsh, var. lucida, Britton.) North Pownal, *Eggleston.*

R. PIMPINELLIFOLIA, L. Naturalized in pasture, Johnson, *Grout.*

R. RUBIGINOSA, L. Sweet-brier. Old pastures ; frequent.

RUBUS. BLACKBERRY. RASPBERRY

R. **argutus,** Link. (R. villosus, var. frondosus, Torr.) Thickets and way-sides ; frequent.

R. **argutus,** Link. var. **Randii,** Bailey. Dry thickets ; occasional.

R. **Canadensis,** L. (R. Millspaughii, Britton.) Thornless Blackberry. Moist thickets in mountains ; common.

R. **hispidus,** L. Running Swamp Blackberry. Moist woods ; frequent.

R. **Idaeus,** L. var. **anomalus,** Arrhenius. (Rhodora 2 : 195, 1900.) Crevices of limestone ledges. Cavendish, *Eggleston.* Heretofore known only as a very rare plant of northern Europe.

R. **Idaeus,** L. var. **strigosus,** Maxim. Red Raspberry. Thickets and hills ; common.

R. **neglectus,** Peck. (R. strigosus × occidentalis, C. F. Austin.) Purple Raspberry. Richmond, *Pringle;* Burlington, *Jones.*

R. **nigrobaccus,** Bailey. (R. villosus, authors not of Ait.) Thickets and way-sides ; common.

R. nigrobaccus, Bailey, var. **albinus**, Bailey. White Blackberry. Pittsfield, *Eggleston ;* occasional.

R. occidentalis, L. Black Raspberry. Rich shaded hillsides ; common.

R. odoratus, L. Purple-flowering Raspberry. Moist shaded hillsides ; common.

R. sativus, Brainerd. (R. nigrobaccus, Bailey. var. sativus, Bailey.) In dry alluvial soil ; Weybridge, *Brainerd ;* West Rutland, *Eggleston.*

R. setosus, Bigelow. Moist soil, especially in the mountains ; frequent.

R. triflorus, Richardson. (R. Americanus, Britton.) Dwarf Raspberry. Moist cool soil ; common.

R. villosus, Ait. (R. Canadensis, of Gray Manual, not of L.) Dewberry. Banks and shores ; common.

R. nigrobaccus × villosus, Bailey. Weybridge, *Brainerd ;* Fair Haven, *Eggleston.*

SPIRÆA

S. lobata, Jacq. (Ulmaria rubra, Hill.) Roadside escape. Peacham, *Blanchard ;* Randolph, *Bates ;* Lower Cabot, *Eggleston.*

S. salicifolia, L. var. **latifolia**, Wiegand. (See Rhodora 2 : 103. 1900.) Meadow Sweet. Wet meadows and cliffs ; common.

S. SORBIFOLIA, L. A garden escape, well established in several stations, e. g. Brattleboro, Burlington.

S. tomentosa, L. Steeple Bush. Hardhack. Rocky pastures ; common.

S. ULMARIA, L. (Ulmaria Ulmaria, Borkh.) English Meadow Sweet. Randolph, *Bates ;* Mendon, *Eggleston.*

WALDSTEINIA

W. fragarioides, Tratt. Barren Strawberry. Wooded hillsides ; common.

LEGUMINOSAE. PULSE FAMILY

AMPHICARPA

A. monoica, Nutt. (Falcata comosa, Kuntze) Thickets ; common.

APIOS

A. tuberosa, Moench. (A. Apios, MacM.) Ground-nut. Low moist ground ; frequent.

ASTRAGALUS

A. alpinus, L. Rocky shores of Connecticut River ; occasional.

A. **Blakei,** Eggleston. (Bot. Gaz. 20:271. 1895.) Alpine Cliffs. Willoughby Mountain, *J. Blake;* Smuggler's Notch and Underhill Notch, Mt. Mansfield, type stations.

A. **Canadensis,** L. Shores and islands of Lake Champlain; frequent.

A. **Robbinsii,** Gray. On limestone rocks, near High Bridge, Winooski River, Burlington, *Robbins.* This, the only station in Vermont, was destroyed in 1894 by the set back of the dam of the Vermont Electrical Power company.

A. **Robbinsii,** Gray. var. **Jesupi,**[1] Eggleston and Sheldon. Rocky shores of the Connecticut River.

BAPTISIA

B. AUSTRALIS, R. Br. Royalton, *Ward.* (Rhodora, 2 : 172. 1900.)

B. **tinctoria,** R. Br. Wild Indigo. Dry open fields; Vernon, *Grout;* Pownal, *Churchill.*

CASSIA. Senna

C. **Marilandica,** L. Wild Senna. Alluvial soil; "Orwell," *Dr. Hill;* "Bellows Falls," *Carey;* Randolph, *Bates;* Hartford, *Jesup.*

C. **nictitans,** L. Wild Sensitive plant. Vernon, *Grout.*

CORONILLA

C. VARIA, L. Randolph, *Bates.* Escaped from garden.

CROTALARIA

C. **sagittalis,**[1] L. Rattlebox. Railroad banks; Vernon, *Grout.*

DESMODIUM. (MEIBOMIA.) Tick Trefoil

D. **acuminatum,** DC. (M. grandiflora, Kuntze.) Rich woods; common.

D. **Canadense,** DC. Dry rich woods; common.

D. **cuspidatum,** Torr. & Gray. (M. bracteosa, Kuntze.) Dry open woods. North Pownal, *Eggleston.*

D. **Dillenii,** Darlingt. Open woodlands; frequent.

D, **nudiflorum,** DC. Dry woods; common.

D. **paniculatum,** DC. Copses; occasional.

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1 This plant in the unpressed state has the flattened *entire* pod of Robbinsii. Both this and *A. Blakei* are difficult to determine from pressed specimens since most of the sulcate appearance of the latter presses out.—*W. W. Eggleston.*

HEDYSARUM

H. boreale, Nutt. "Willoughby Mountain," *A. Wood;* Smuggler's Notch, *Pringle.*

LATHYRUS

L. maritimus, Bigelow. Beach Pea. Shores of Lake Champlain; occasional.

L. ochroleucus, Hook. Headlands of northern Lake Champlain; occasional.

L. palustris, L. Shores of Lake Champlain; frequent.

L. palustris, L. var. **myrtifolius,** Gray. "Vermont," Torrey and Gray. "Island in Ferrisburgh," *Morong,* in Walter Deane herbarium, Cambridge, Mass.

LESPEDEZA. Bush Clover

L. capitata, Michx. Sandy soil; frequent.

L. frutescens, Britton. (L. Stuvei, Nutt. var. intermedia, Wats.) Dry open places; occasional.

L. polystachya, Michx. Dry open woods; occasional.

L. violacea, Pers. Dry woods. "Rockingham," *Carey;* Gardiner's Island, *Pringle.*

LUPINUS

L. perennis, L. Wild Lupine. Common in sand plains along Lake Champlain.

MEDICAGO. Medick

M. Arabica, All. (M. maculata, Sibth.) Experiment Station, Burlington, *Jones.*

M. denticulata, Willd. Ludlow, *Miss Pollard*; Hartland, *B. P. Ruggles;* Burlington, *Jones.*

M. lupulina, L. Black Medick. Roadsides and fields; common.

M. sativa, L. Alfalfa. Often cultivated and persistent or escaped.

MELILOTUS. Sweet Clover

M. alba, Lam. White Melilot. Waste or cultivated grounds; frequent.

M. officinalis, Willd. Yellow Melilot. Roadsides or waste places; occasional.

ROBINIA. Locust

R. Pseudacacia, L. Locust. Frequent in cultivation and escaped.

R. viscosa, Vent. Clammy Locust. Occasional in cultivation and tending to spread.

TRIFOLIUM. Clover.

T. agrarium, L. Yellow or Hop Clover. Sandy soil; frequent.

T. arvense, L. Rabbitfoot Clover. Old fields; frequent.

T. hybridum, L. Alsike Clover. Common.

T. pratense, L. Red Clover.[1] Common.

T. repens, L. White Clover. Common.

VICIA. Vetch

V. Cracca, L. Blue Vetch. Meadows and roadsides; frequent.

V. sativa, L. Common Vetch. Adventive; occasional. White flowered form, Starr Farm, Burlington, *Mrs. Flynn.*

V. sativa, L. var. angustifolia, Seringe. (V. angustifolia, Roth.) Middlebury, *Brainerd.*

V. tetrasperma, L. Meadows and pastures; occasional.

GERANIACEAE. GERANIUM FAMILY

ERODIUM

E. cicutarium, L'Her. Stork's bill. Old gardens. Ludlow, *Miss Pollard;* Burlington, *Mrs. A. J. Grout.*

FLŒRKEA

F. proserpinacoides, Willd. Castleton, *Robbins;* Shelburne, *Pringle.*

GERANIUM

G. Bicknellii, Britton. (G. Carolinianum, L. var. longipes, Wats.) Dry rocky places; frequent.

G. maculatum, L. Cranesbill. Open woods; frequent.

G. Robertianum, L. Herb Robert. Rocky woods and ravines; common.

IMPATIENS. Jewel-weed. Touch-me-not

I. aurea, Muhl. (I. pallida, Nutt.) Moist shady places, especially on mountain sides.

I. biflora, Walt. (I. fulva, Nutt.) Moist shady places; common.

OXALIS. Wood Sorrel

O. Acetosella, L. Wood Sorrel. Cool moist woods; common on mountain sides.

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1 Mammoth Red Clover, *T. medium*, L., is occasionally cultivated and is quite as hardy as is the common Red Clover. It has not been observed, however, except in cultivation.

O. cymosa, Small. (O. corniculata, L. var. stricta, of Gray Manual.) Lady's Sorrel. Fields and gardens; common.

O. stricta, L. Lady's Sorrel. (O. corniculata, L. var. Dillenii, Trelease.) Burlington, *T. E. Hazen.*

LINACEAE. FLAX FAMILY

LINUM

L. USITATISSIMUM, L. Flax. Occasionally adventive.

RUTACEAE. RUE FAMILY

RUTA

R. GRAVEOLENS, L. Rue. Well established at Weybridge, *Brainerd.*

XANTHOXYLUM

X. Americánum, Mill. Prickly Ash. Rocky woods and banks; occasional.

POLYGALACEAE. MILKWORT FAMILY

POLYGALA

P. paucifolia, Willd. Fringed Polygala. Common, especially in light soil.

P. polygáma, Walt. Dry sandy soil; occasional.

P. sanguinea, L. (P. viridescens, L.) Moist sandy soil. Windsor, *Leland;* Newfane, *Grout;* Burlington, *Mrs. Flynn;* Milton, *Jones.*

P. Senega, L. Seneca Snake-root. Rocky soil; western Vermont; occasional.

P. verticillata, L. Sandy soil. "Bellows Falls," *Tuckerman;* Brattleboro, *Grout;* Vernon, *B. L. Robinson;* Pownal, *Eggleston.*

P. verticillata, L. var. **ambigua,** Wats. and Coult. (P. ambigua, Nutt.) Pownal, *Robbins;* Vernon, *B. L. Robinson;* Brattleboro, *Grout;* Burlington, *Howe.*

EUPHORBIACEAE. SPURGE FAMILY

ACALYPHA

A. Virginica, L. Moist hollows in fields; frequent.

EUPHORBIA. SPURGE

E. corollata, Sandy field. Burlington, *Mrs. Flynn;* recently introduced from the west.

E. CYPARISSIAS, L. Cypress Spurge. Old cemeteries and roadsides; common.

E. Helioscopia, L. Waste places and gravelly shores; frequent in the Champlain valley.

E. **hirsuta**, Wiegand. (See appendix in Britton and Brown Flora.) Manchester, *Miss Day;* North Pownal, *Eggleston.*

E. **maculata**, L, Common in waste places.

E. **Preslii**, Guss. (E. nutans, Lag.) Waste places; occasional.

E. Peplus, L. Charlotte, *Pringle;* Wallingford, *Brainerd.*

E. platyphylla, L. Shores and waste places; occasional.

EMPETRACEAE

EMPETRUM. Crowberry

E. **nigrum**, L. Summits of Mt. Mansfield and Camel's Hump, *Robbins.*

ANACARDIACEAE

RHUS. Sumach

R. **Canadensis**, Marsh. (R. aromatica, Ait.) Dry rocky banks of western Vermont; occasional.

R. **copallina**, L. Rocky hills; frequent.

R. **glabra**, L. Rocky soil; common in the Connecticut and Hoosic valleys. South Charlotte, *Horsford;* Colchester, *Mrs. Flynn.*

R. **Toxicodendron**, L. (R. radicans, L.) Poison Ivy. Banks and moist thickets; common.

R. **typhina**, L. (R. hirta, Sudw.) Staghorn Sumach. Hillsides; common.

R. **Vernix**, L. (R. venenata, DC.) Poison Sumach. Occasional in swamps.

ILICINEAE. HOLLY FAMILY

ILEX. Holly

I. **verticillata**, Gray. Winterberry. Thickets; common.

I. **verticillata**, Gray. var. **tenuifolia**, Wats. (Rhodera 2 : 105, 1900.) Mouth of Winooski River, *Eggleston.*

NEMOPANTHUS

N. **fascicularis**, Raf. (Ilicioides mucronata, Britton.) Mountain Holly. Cold wet woods; frequent.

CELASTRACEAE

CELASTRUS

C. scandens, L. Bittersweet. Moist banks and thickets ; common.

SAPINDACEAE. MAPLE FAMILY

ACER. Maple

A. Negundo, Linn. (Negundo aceroides, Moench.) Boxelder. Frequent along the banks of the Winooski River.

A. Pennsylvanicum, L. Striped Maple. Rich woods ; common.

A. rubrum, L. Red Maple. Moist woods and swamps ; common.

A. saccharinum, L. (A. dasycarpum, Ehrh.) Silver Maple. Banks of rivers and lakes at low altitudes ; frequent.

A. Saccharum, Marsh. (A. saccharinum, Wang.) Sugar Maple. Rich woods; common.

A. Saccharum, Marsh. var. **nigrum,** Britton. Black Sugar Maple. Moist soil, Lake Champlain valley ; occasional. "Windsor," *Michaux.*

A. spicatum, Lam. Mountain Maple. Cool ravines and mountain woodlands ; common,

STAPHYLEA

S. trifolia, L. Bladder-nut. Moist woods and thickets ; occasional.

RHAMNACEAE. BUCKTHORN FAMILY

CEANOTHUS

C. Americanus, L. New Jersey Tea. Dry woodlands ; common.

C. ovatus, Desf. Sandy banks of Lake Champlain, Burlington.

RHAMNUS. Buckthorn

R. alnifolia, L'Her. Swamps ; frequent.

R. CATHARTICA, L. Buckthorn. Common in cultivation and a frequent escape in woods and fields.

VITACEAE. VINE FAMILY

AMPELOPSIS. Woodbine

A. quinquefolia, Michx. Moist thickets ; common.

A. quinquefolia, Michx. var. **radicantissima,** Rehder. Clinging closely to limestone ledges. Cornwall, *Brainerd;* Burlington, *Jones.*

VITIS. Grape

V. **bicolor,** LeConte. (V. æstivalis, of Gray Manual in part.) Summer Grape. Dry gravelly soil and at bases of cliffs; frequent.

V. **Labrusca,** L. Fox Grape. Vernon, *Grout.*

V. **vulpina,** L. (V. riparia, of Gray Manual in part.) River Grape. River banks; common.

TILIACEAE. LINDEN FAMILY

TILIA. Linden

T. **Americana,** L. Basswood. Woodlands; common.

MALVACEAE. MALLOW FAMILY

ABUTILON

A. Avicennæ, Gaertn. (A. Abutilon, Rusby.) Velvet Leaf. Roadsides and waste places; occasional.

HIBISCUS

H. Trionum, L. Bladder Ketmia. Occasional as a garden weed. Middlebury, *Brainerd;* Peacham, *Blanchard;* Panton, *Jones.*

MALVA. Mallow

M. Alcea, L. Lyndon, *Congdon;* Rutland, *Eggleston.*

M. moschata, L. Musk Mallow. Roadsides and waste places; an occasional escape.

M. rotundifolia, L. Waste places; everywhere common.

M. sylvestris, L. Occurs sparingly in several places.

M. verticillata, L. A garden weed, increasingly troublesome. Middlebury, *Brainerd;* Burlington, *Jones.*

M. verticillata, L. var. crispa, L. Knight's Island, *Brainerd.*

HYPERICACEAE. ST. JOHNSWORT FAMILY

HYPERICUM. St. Johnswort

A. **Ascyron,** L. River banks; occasional.

H. **boreale,** Bicknell. Manchester, *Miss Day.*

H. **Canadense,** L. Moist soil; frequent.

H. **Canadense,** L. var. **majus,** Gray. Moist soil; occasional.

H. ellipticum, Hook. Wet places; frequent.

H. maculatum, Walt. Damp places; frequent.

H. mutilum, L. Low ground; common

H. nudicaule, Walt. (Sarothra gentianoides, L.) Brattleboro, *Frost, Grout.*

H. PERFORATUM, L. Common St. Johnswort. Fields and roadsides; common.

H. Virginicum, L. (Elodes campanulata, Pursh., Triadenum Virginicum Raf.) Swamps; frequent.

CISTACEAE. ROCK ROSE FAMILY

HELIANTHEMUM. Rock Rose

H. Canadense, Michx. Windham County, *B. L. Robinson;* Fairlee Cliffs, *Sargent* and *Eggleston;* Bald Mountain, Shrewsbury, *Eggleston.*

H. majus, B. S. P. Sterile soil; frequent.

HUDSONIA

H. tomentosa, Nutt. Sandy beaches. Lake Champlain, Burlington Bay, Colchester Point, *Bigelow;* Apple Tree Bay, *Mrs. Flynn.*

LECHEA. Pinweed

L. intermedia, Leggett. Dry sterile soil; occasional.

L. major, Michx. (L. villosa, Ell.) Vernon, *B. L. Robinson.*

VIOLACEAE. VIOLET FAMILY

VIOLA. Violet

V. arenaria, DC. (V. canina, L. var. puberula, Watson.) Sand Violet. Rocky or sandy soil; occasional. Abundant on sand plains about Burlington.

V. blanda, Willd. White Violet. Low wet ground; common.

V. blanda, Willd. var. **palustriformis,** Gray. (V. blanda, Willd, var. amoena, B. S. P.) Cool rich woods; occasional.

V. blanda, Willd. var. **renifolia,** Gray. (V. renifolia, Gray.) Wet mossy woods and swamps; frequent.

V. Canadensis, L. Canada Violet. Woods; common.

V. canina, L. var. **Muhlenbergii,** Trautv. (V. Labradorica, Schrank.) Dog Violet. Low shady ground; common.

V. lanceolata, L. Moist places. Mud Pond, Rutland, *Eggleston;* "Williston," *Bates;* Lily Pond, Vernon, *Grout.*

V. ovata, Nutt. (V. sagittata, of Gray Manual in part.) Dry sandy soil; frequent.

V. palmata, L. Blue Violet. Rich open woods. Pownal, *Robbins*, *Eggleston*.

V. palmata, L. var. **cucullata,** Gray. (V. obliqua, Hill.) Moist or dry ground; common. A polymorphous group which recent authors are dividing into many species.

V. pubescens, Ait. Downy Yellow Violet. (Including var. *eriocarpa* Nutt.) Rich woods; common.

V. pubescens, Ait. var. **scabriuscula,** Torr. and Gray. (V. scabriuscula, Schwein.) In moister situations; frequent.

V. rostrata, Pursh. Long-spurred Violet. Rich woods; common.

V. rotundifolia, Michx. Round-leaved Violet. Cool moist woods; frequent.

V. Selkirkii, Pursh. Rich moist woods, especially in the mountains; occasional.

V. TRICOLOR, L. Pansy. Persistent in old gardens.

THYMELAEACEAE

DAPHNE

D. MEZEREUM, L. Garden escape, in rocky woods. Burlington, *Jones*.

DIRCA

D. palustris, L. Leatherwood. Moist open woods; frequent.

AEAGNACEAE

SHEPHERDIA

S. Canadensis, Nutt. Red sandstone cliffs, western Vermont; occasional.

LTHYRACEAE. LOOSESTRIFE FAMILY

DECODON

D. verticillatus, Ell. Swampy ground; occasional in western Vermont.

LYTHRUM. LOOSESTRIFE

L. alatum, Pursh. Charlotte, *Pringle*.

L. SALICARIA, L. Wet meadows. Rutland, *Bigelow* and *Eggleston*; Sharon, *Jesup* and *Sargent*; Clarendon, *Grout*; Wallingford, *Mrs. Flynn*.

MELASTOMACEAE

RHEXIA. Deer-grass

R. Virginica, L. "Brattleboro," *Frost;* Lily Pond, Vernon, *Grout.*

ONAGRACEAE. EVENING PRIMROSE FAMILY

CIRCÆA. Enchanter's Nightshade

C. alpina, L. Deep woods; common.

C. intermedia, Ehrh. Manchester, *Miss Day;* Dorset, *Eggleston.*

C. Lutetiana, L. Woods; frequent.

EPILOBIUM. Willow Herb

E. adenocaulon, Haussk. Moist places, especially among the mountains; frequent.

E. angustifolium, L. (Chamaenerion angustifolium, Scop.) Fireweed. Common, especially in newly cleared lands.

E. coloratum, Muhl. Wet places; common.

E. lineare, Muhl. Bogs; common.

E. lineare, Muhl. var. **oliganthum,** Trelease. Bogs, deep in mountain woods, Stratton, *Grout;* North Pond, Sunderland, *Eggleston.*

E. strictum, Muhl. Cold bogs; occasional. "Narrow-leaved form, south end of Lake Willoughby," *E. Faxon.*

LUDWIGIA

L. palustris, Ell. (Nardia palustris, L.) Ditches and swamps; common.

ŒNOTHERA. Evening Primrose

OE. biennis, L. (Onagra biennis, Scop.) Dry soil; common.

OE. cruciata, Nutt. (Œ. biennis, L. var. cruciata, Torr. & Gray.) Brattleboro and Vernon, *Grout.*

OE. pumila, L. (Kneiffia pumila, Spach.) Fields; common.

HALORAGEAE

CALLITRICHE

C. autumnalis, L. (C. bifida, Morong.) Kelly's Bay, Alburgh, *Pringle.*

C. palustris, L. (C. verna, L.) Cold or running water; frequent.

HIPPURIS. Mare's Tail

H. vulgaris, L. Rare; in cold springy margin of Joe's Pond, West Danville, *Blanchard.*

MYRIOPHYLLUM. Water Milfoil

M. alterniflorum, DC. "Gut," Lake Champlain, *Pringle* and *Brainerd.*

M. ambiguum, Nutt. (M. humile, Morong.) West River, West Townshend, *Grout.*

M. Farwellii, Morong. Mountain ponds. Belden's Pond, Johnson; Townshend, *Grout;* Spectacle Pond, Wallingford; North Pond, Brunswick; Little Averill Pond, *Eggleston.*

M. spicatum, L. In deep water; common.

M. tenellum, Bigelow. Borders of ponds. Grand Isle, *Pringle;* Joe's Pond, West Danville, *Blanchard;* Fairlee Lake, *Jesup* and *Sargent.*

PROSERPINACA

P. palustris, L. Swamps; occasional.

ARALIACEAE. GINSENG FAMILY

ARALIA. Wild Sarsaparilla

A. hispida, Vent. Bristly Sarsaparilla. Rocky or sandy woodlands; frequent.

A. nudicaulis, L. Sarsaparilla. Moist woodlands; common.

A. quinquefolia, Decsne. & Planch. (Panax quinquefolium, L.) Ginseng. Rich woods; formerly common, now rapidly disappearing.

A. racemosa, L. Spikenard. Rich woodlands; frequent.

A. trifolia, Decsne. & Planch. (Panax trifolium, L.) Ground-nut. Moist woods and thickets; common.

UMBELLIFERAE. PARSLEY FAMILY

ANGELICA

A. atropurpurea, L. Swamps and moist grounds; frequent.

CARUM

C. Carui, L. Caraway. About dwellings and roadsides; frequent.

CICUTA

C. bulbifera, L. Water Hemlock. Swamps; common.

C. maculata, L. Spotted Cowbane. Low grounds; frequent.

CONIOSELINUM

C. Canadense, Torr. and Gray. (C. Chinense, B. S. P.) Swamps and cold cliffs; occasional.

CONIUM

C. MACULATUM, L. Poison Hemlock. Waste places; occasional.

CRYPTOTÆNIA

C. Canadensis, DC. (Deringa Canadensis, Kuntze.) Moist woods; common.

DAUCUS. CARROT

D. CAROTA, L. Wild Carrot. Old meadows; common.

HERACLEUM

H. lanatum, Michx, Cow Parsnip. Cold moist ground; frequent.

HYDROCOTYLE

H. Americana, L. Wet places; common.

LEVISTICUM

L. OFFICINALE, Koch. Lovage. Occasionally adventive.

OSMORRHIZA (WASHINGTONIA) SWEET CICELY

O. brevistylis, DC. (W. Claytoni, Britton) Rich woods; common.

O. longistylis, DC. Moist rich woods; occasional.

PASTINACA

P. SATIVA, L. Wild Parsnip. Roadsides and waste places; common.

PIMPINELLA

P. integerrima, A. Gray. Rocky shores of Lake Champlain; occasional.

SANICULA,[1] BLACK SNAKEROOT

S. Canadensis, L. Shaded ledges; frequent.

S. gregaria, Bicknell. Moist rich soil; frequent.

S. Marylandica, L. Moist woods; common.

S. trifoliata, Bicknell. Rich woods; frequent.

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1 See E. Brainerd. The Saniculas of Western Vermont. Rhodora. **1** : 7. 1899.

SIUM

S. cicutaefolium, Gmelin. Water Parsnip. Wet places; frequent.

ZIZIA

Z. aurea, Koch. Moist meadows; common.

CORNACEAE. DOGWOOD FAMILY

CORNUS. Cornel. Dogwood

C. alternifolia, L. f. Open woods; common.

C. Canadensis, L. Bunch-berry. Cold damp woods; common.

C. circinata, L'Her. Round-leaved Cornel. Rocky woodlands; frequent.

C. florida, L. Flowering Dogwood. Dry woods. "Castleton," *Robbins;* Springfield, *S. Hayward;* Newfane and Dorset, *S. Grout;* North Pownal, *Eggleston.*

C. paniculata, L'Her. (C. candidissima, Marsh.) Rich thickets and banks; frequent.

C. sericea, L. (C. Amonum, Mill.) Kinnikinnik. Silky Cornel. Low woods and banks; common.

C. stolonifera, Michx. Red-osier Dogwood. Wet places; common.

NYSSA

N. sylvatica, Marsh. Sour Gum. Tupelo. Rich soil, generally swampy. "Craftsbury," *Robbins*; East Dorset, *S. Grout;* Vernon, *Grout;* Burlington, *Mrs. Flynn;* Vergennes, *Miss Ruth Fisher.*

ERICACEAE. HEATH FAMILY

ANDROMEDA

A. ligustrina, Muhl. (Xolisma ligustrina, Britton.) Occasional in southern Vermont.

A. polifolia, L. Boggy margins of ponds; frequent.

ARCTOSTAPHYLOS. Bearberry

A. Uva-ursi, Spreng. Cliffs and bare hills; occasional.

CASSANDRA. (CHAMÆDAPHNE)

C. calyculata. Don. Leather Leaf. Bogs; frequent.

CHIMAPHILA. Pipsissewa

C. maculata, Pursh. Prince's Pine. Dry woods. Newfane, *Grout.*

C. umbellata, Nutt. Dry woods; common.

CHIOGENES

C. serpyllifolia, Salisb. Creeping Snowberry. Peat bogs and mossy woods; frequent.

EPIGÆA

E. repens, L. Mayflower. Trailing Arbutus. Sandy or rocky woodlands; common in certain areas.

GAULTHERIA

G. procumbens, L. Wintergreen. Cool woods; common.

GAYLUSSACIA

G. resinosa, Torr. and Gray. Huckleberry. Sterile fields and thickets; common.

KALMIA. Laurel

K. angustifolia, L. Sheep Laurel. Sterile fields and peat bogs; frequent.

K. glauca, Ait. Pale Laurel. Cold peat bogs; occasional.

K. latifolia, L. Mountain Laurel. Rocky hills. "Rockingham," *Carey;* Pownal, *Eggleston.* Common along banks of West River between Brattleboro and Newfane.

LEDUM

L. Groenlandicum, Oeder. (L. latifolium, Ait.) Labrador Tea. Cold bogs; frequent.

MONESES

M. grandiflora, Salisb. (M. uniflora, A. Gray.) Deep cold woods; occasional.

MONOTROPA. Indian Pipe

M. Hypopitys, L. (Hypopitys Hypopitys, Small.) Rich dry woods; occasional.

M. uniflora, L. Dark rich woods; common.

PTEROSPORA

P. Andromedea, Nutt. Pine woods; rare.

PYROLA

P. chlorantha, Swartz. Dry woods; frequent.

P. elliptica, Nutt. Rich woods; common.

P. minor, L. Smuggler's Notch, *Pringle.* Rare.

P. rotundifolia, L. Woodlands; occasional.

P. rotundifolia, L. var. **uliginosa,** Gray. Sphagnum bogs. Bristol, *Pringle*; Peacham, *Blanchard;* Rutland, *Ross;* Chittenden, *Eggleston;* Burlington, *Mrs. Flynn.*

P. secunda, L. Rich woods; frequent.

P. secunda, L. var. **pumila,** Gray. Peat bogs. Bristol Pond bog, *Pringle;* Sutton and Newark, *E. Faxon;* cedar swamp, Fairhaven, *Eggleston.*

RHODODENDRON

R. canescens, G. Don. (R. nudiflora, of Gray Manual in part, Azalea canescens, Michx.) Swamp Pink. Woody banks and borders of swamps; occasional.

R. maximum, L. Rocky woods bordering Groton Pond, *Perkins;* "Peacham," *Blanchard:* Martin's and Niggerhead Ponds, *Eggleston*; Lanesboro, *Miss M. Skinner.*

R. Rhodora, Don. (Rhodora Canadensis, L.) "Brattleboro," *Robbins;* Burlington, *Perkins;* Derby, Richmond, *Horsford;* Johnson, *Grout;* abundant in Essex County, *Eggleston.*

VACCINIUM. Blueberry. Cranberry

V. caespitosum, Michx. Mt. Mansfield Chin, *Pringle;* rocky shore West River, Newfane, *Grout.*

V. Canadense, Kalm. Moist thickets; common in the mountains. The market blueberry of Essex County.

V. corymbosum, L. Swamps and low thickets. The abundant blueberry about northern Lake Champlain. The form known as var. **amoenum,** Gray, occurs in swamps, Monkton, Charlotte, *Pringle.*

V. corymbosum, var. **atrococcum,** Gray. (V. atrococcum, Heller.) Black Blueberry. Bristol Pond bog, *A. C. Dyke.* Also reported from several other localities but the determinations have not been verified.

V. macrocarpon, Ait. Large Cranberry. (Oxycoccus macrocarpus, Pers.) Peat bogs; frequent.

V. Oxycoccus, L. Small Cranberry. (Oxycoccus Oxycoccus, McM.) In cold peat bogs; frequent.

V. Pennsylvanicum, Lam. Dry hills ; common. The earliest market blueberry. Plant having black berries without bloom (? V. nigrum, Britton) are found ; West Rutland, *Eggleston.*

V. Pennsylvanicum, Lam. var. **angustifolium,** Gray. Summit of Mt. Mansfield and Camel's Hump, *Robbins, Pringle.*

V. uliginosum, L. Summit of Mt. Mansfield and Camel's Hump, *Robbins, Pringle ;* Johnson, *Grout.*

V. vacillans, Solander. Dry woodlands ; common ; forming part of the later blueberries of the market.

V. Vitis-Idaea, L. On the summits of Mansfield and Camel's Hump mountains, *Robbins.*

DIAPENSIACEAE

DIAPENSIA

D. Lapponica, L. Mt. Mansfield Chin, *Pringle.*

PRIMULACEAE. PRIMROSE FAMILY

LYSIMACHIA. Loosestrife

L. NUMMULARIA, L. Moneywort. Frequent as a troublesome weed in lawns.

L. producta, Fernald. (Rhodora, 1 : 134. 1899.) (L. stricta, var. producta, Gray.) Mouth of the Winooski River, *Eggleston* and *Jones.*

L. quadrifolia, L. Dry thickets ; common.

L. stricta, Ait. (L. terrestris, B. S. P.) Low ground ; common.

L. thyrsiflora, L. (Naumbergia thyrsiflora, Duby.) Bogs and swamps ; frequent.

PRIMULA

P. Mistassinica, Michx. Willoughby Mountain, *A. Wood ;* Smuggler's Notch, *Morong.*

SAMOLUS

S. Valerandi, L. var. **Americanus,** Gray. (S. floribundus, H. B. K.) Along sluggish brooks ; Middlebury, *James, C. N. Brainerd ;* "Brattleboro," *Frost.*

STEIRONEMA

S. ciliatum, Raf. Moist thickets ; common.

S. lanceolatum, Gray. Low grounds along northern Lake Champlain : occasional.

TRIENTALIS

T. Americana, Pursh. Star Flower. Moist woods and thickets; common.

OLEACEAE. OLIVE FAMILY

FRAXINUS. Ash

F. Americana, L. White Ash. Rich woods ; common.

F. Pennsylvanica, Marsh. (F. pubescens, Lam.) Red Ash. Low grounds ; common along Lake Champlain and its tributaries.

F. nigra, Marsh. (F. sambucifolia, Lam.) Black Ash. Swamps and wet woods ; common.

F. lanceolata, Borck. (F. viridis, Michx. f.) Green Ash. Occasional along shores of Lake Champlain.

GENTIANACEAE. GENTIAN FAMILY

BARTONIA

B. tenella, Muhl. (B. Virginica B. S. P.) "Rockingham," *Carey ;* Higbee swamp, Burlington, *Jones.*

GENTIANA. Gentian

G. Amarella, L., var. **acuta,** Hook. f. (G. acuta. Michx.) Smuggler's Notch, *Pringle.*

G. Andrewsii, Griseb. Closed Gentian. Moist grounds ; frequent.

G. crinita, Froel. Fringed Gentian. Moist ground ; frequent in the southern part of the State.

G. linearis, Froel. Bogs and meadows in the mountains ; occasional. A broad leaved form from Stowe, *Mrs. Straw*, appears to be var. *lanceolata*, Gray.

G. quinqueflora, Lam. (G. quinquefolia, L.) Moist hills ; occasional.

HALENIA. (TETRAGONANTHUS)

H. deflexa, Griseb. Banks of Lewis Creek. Charlotte, *Horsford* and *Pringle.*

LIMNANTHEMUM

L. lacunosum, Griseb. Shallow water ; Spectacle Pond, East Wallingford, *Kent ;* Springfield, *Eggleston ;* common in Windham county ; *Grout.*

MENYANTHES

M. trifoliata, L. Buck Bean. Sphagnum bogs ; occasional.

APOCYNACEAE. DOGBANE FAMILY

APOCYNUM. Dogbane

A. androsaemifolium, L. Thickets and fields ; common.

A. cannabinum, L. Indian Hemp. Moist banks ; occasional.

A. cannabinum, L. var. **glaberrimum**, DC. Shores of Lake Champlain. Sands of West River, *Eggleston.*

VINCA

V. minor, L. Periwinkle. Persisting in neglected dooryards.

ASCLEPIADACEAE. MILKWEED FAMILY

ASCLEPIAS. Milkweed

A. incarnata, L. Marshes ; common.

A. obtusifolia, Michx. Sandy soil ; frequent about Burlington.

A. phytolaccoides, Pursh. (A. exaltata, Muhl.) Moist copses ; occasional.

A. quadrifolia, L. Rocky woods ; occasional.

A. Syriaca, L. (A. Cornuti, Decaisne.) Rich grounds ; common.

A. tuberosa, L. Butterfly Weed. Dry fields ; Pownal.'' *Robbins ;* "Bellows Falls," *Carey ;* Vernon, *Grout ;* Manchester, *Miss Day.*

VINCETOXICUM. (CYNANCHUM)

V. nigrum, Moench. Brattleboro, *Frost ;* Windsor, *Leland.*

CONVOLVULACEAE. MORNING-GLORY FAMILY

CONVOLVULUS. Bindweed

C. arvensis, L. A garden weed ; Woodstock, *F. B. Dana.*

C. Japonicus, Thunb. The double-flowered form, an occasional escape from cultivation.

C. sepium, L. Moist thickets ; common.

C. sepium, L. var. **Americanus**, Sims. Common in the gravelly soil along shores of Lake Champlain.

C. spithamaeus, L. Dry sandy plains ; common about Burlington. Norwich and Rutland, *Eggleston.*

CUSCUTA. Dodder

C. Epithymum, Murr. In clover fields; threatening to become troublesome.

C. Gronovii, Willd. Moist thickets ; common.

POLEMONIACEAE. PHLOX FAMILY

PHLOX

P. paniculata, L. Escaped from cultivation ; Rutland, *Eggleston* ; Franklin, *Wild.*

POLEMONIUM

P. Van Bruntiae, Britton. (P. cæruleum, of Gray Manual.) Abby Pond, Ripton, *Brainerd.*

HYDROPHYLLACEAE

HYDROPHYLLUM

H. Virginicum, L. Rich woods ; common.

BORRAGINACEAE

CYNOGLOSSUM

C. OFFICINALE, L. Hound's-tongue. Pastures ; frequent.

C. Virginicum, L. Wild Comfrey. Rich woods ; occasional.

ECHINOSPERMUM. (LAPPULA)

E. LAPPULA, Lehm. Gravelly shores of Lake Champlain ; frequent.

E. Virginicum, Lehm. (L. Virginiana, Greene.) Beggar's Lice. Borders of woods ; frequent.

ECHIUM. VIPER'S BUGLOSS

E. VULGARE, L. Blueweed. Pastures and moist soil. Becoming increasingly troublesome as a weed .

LITHOSPERMUM. GROMWELL

L. ARVENSE, L. Old fields and roadsides ; occasional.

L. OFFICINALE, L. Dry pastures ; common.

MYOSOTIS

M. laxa, Lehm. Cold brooks. Peacham, *Blanchard* ; abundant in White River valley, *Eggleston.*

M. PALUSTRIS, Withering. Forget-me-not. Frequently naturalized along cold brooks.

M. verna, Nutt. (M. Virginica, B. S. P.) Dry banks and ledges. "Brattleboro," *Frost;* Windsor, *Leland;* Snake Mountain, *Brainerd;* Fairlee Cliffs and West Castleton, *Eggleston.*

SYMPHYTUM

S. OFFCINALE, L. Comfrey. Moist places; adventive.

VERBENACEAE. VERVAIN FAMILY

PHRYMA

P. Leptostachya, L. Moist open woods; frequent.

VERBENA. Vervain

V. hastata, L. Blue Vervain. Roadsides; common.

V. urticaefolia, L. White Vervain. Roadsides; common.

LABIATAE. MINT FAMILY

BLEPHILIA

B. ciliata, Raf. Dry open places. East Dorset, *S. Grout;* Manchester, *Miss Day.*

B. hirsuta, Benth. Moist shady places; occasional.

B. hirsuta, Benth. var. **glabrata,** Fernald. (Rhodora I:221. 1899.) Dry soil. Manchester, *Miss Day.*

CALAMINTHA.

C. Clinopodium, Benth. (Clinopodium vulgare, L.) Borders of thickets and fields; frequent.

COLLINSONIA

C. Canadensis, L. Rich moist woods of southern and central Vermont; occasional.

GALEOPSIS

G. TETRAHIT, L. Hemp Nettle. Waste places; common.

HEDEOMA

H. pulegioides, Pers. Pennyroyal. Dry fields; common.

HYSSOPUS

H. OFFICINALIS, L. Hyssop. Roadsides. Grand Isle, *Pringle;* South Wallingford, *Ross;* Peacham, *Blanchard.*

ISANTHUS

I. caeruleus, Michx. (I. brachiatus, B. S. P.) Dry sterile fields; rare.

LAMIUM. Dead Nettle

L. amplexicaule, L. Garden weed. Bristol, *Pringle*; Rutland, *Eggleston.*

L. maculatum, L. Garden escape. Bristol, *Pringle*; Middlebury, *Brainerd.*

LEONURUS

L. Cardiaca, L. Motherwort. Waste places; common.

LOPHANTHUS. (AGASTACHE)

L. nepetoides, Benth. Thickets and along fences. Middlebury, *James, Brainerd;* Pownal, Bennington, Arlington, *Robbins.*

L. scrophulariaefolius, Benth. Thickets and fencerows; occasional.

L. scrophulariaefolius, Benth. var. **mollis,** Fernald. (Rhodora **I:** 220. 1899.) Manchester, *Miss Day.*

LYCOPUS

L. Americanus, Muhl. (L. sinuatus, Ell.) Moist soil; common.

L. Virginicus, L. Shady moist places; common.

MARRUBIUM

M. vulgare, L. Horehound. Garden escape. Peacham, *Blanchard.*

MENTHA. Mint

M. Canadensis, L. Wet places; common.

M. piperita, L. Peppermint. Along brooks; frequent.

M. sativa, L. Garden escape. Rochester and Rutland, *Eggleston;* Johnson, *Grout.*

M. viridis, L. Spearmint. Moist places; common.

MONARDA

M. didyma, L. Oswego Tea. Warren, *Brainerd;* Barnet, *Blanchard.*

M. fistulosa, L. Wild Bergamot. Dry open woods; occasional.

M. fistulosa, L. var. **rubra,** Gray. (M. media, Willd.) Garden escape. Stowe, *Eggleston.*

M. punctata, L. Colchester, *Mrs. Flynn.* Doubtless introduced with western seed.

NEPETA

N. Cataria, L. Catnip. Dry pastures ; common.

N. Glechoma, Benth. (Glecoma hederacea, L.) Ground Ivy. Moist shady places ; common.

ORIGANUM

O. vulgare, L. Wild Marjoram. Moist shady ground ; occasional.

PHYSOSTEGIA

P. **Virginiana,** Benth. Gravelly shores of Lake Champlain ; occasional.

PRUNELLA. (BRUNELLA)

P. **vulgaris,** L. Self-heal. Woods and fields ; common. Plants with white flowers occur occasionally.

PYCNANTHEMUM. (KOELLIA)

P. **incanum,** Michx. Rocky woods. Cavendish, *Macrae ;* Barttleboro and North Pownal, *Eggleston.*

P. **lanceolatum,** Pursh. (K. Virginiana, MacM.) Dry woods ; southern and western Vermont ; occasional.

P. **linifolium,** Pursh. (K. flexuosa, MacM.) Dry fields of western Vermont; occasional.

P. **muticum,** Pers. Fields ; occasional.

P. **verticillatum,** Pers. (P. muticum, Gray in part, not Pers. See Bot. Gaz. 28: 132. 1899.) Moist fields ; occasional in western Vermont.

SATUREIA

S. hortensis, L. Summer Savory. Gravelly bank. Outlet of Dorset Pond, *Grout.*

SCUTELLARIA. Skullcap

S. **galericulata,** L. Wet shady places ; common.

S. **lateriflora,** L. Mad-dog Skullcap. Wet shady places ; common.

S. **parvula,** Michx. Dry banks and headlands of Lake Champlain ; local.

STACHYS. Hedge Nettle

S. **aspera,** Michx. Moist ground ; occasional.

S. **palustris,** L. Meadow, East Wallingford, *E. C. Kent.* Specimen in Mr. Kent's herbarium.

TEUCRIUM. Germander

T. **Canadense,** L. Low grounds ; occasional. Frequent along the shores of Lake Champlain.

THYMUS. Thyme

T. Serpyllum, L. Peacham, *Blanchard;* Rock Point, Burlington, *Mrs. Flynn;* West Berkshire, *Wild.*

TRICHOSTEMA

T. **dichotomum,** L. Dry sterile fields; occasional.

SOLANACEAE. NIGHTSHADE FAMILY

DATURA. Jamestown Weed

D. Stramonium, L. Occasional in waste places.

D. Tatula, L. Rare and adventive.

HYOSCYAMUS

H. niger, L. Henbane. Roadsides. "Panton," *Burge;* "Mt. Independence," *Dr. Hill;* Shoreham, *Brainerd.*

LEUCOPHYSALIS

L. **grandiflora,** Rydberg. (Physalis grandiflora, Hook.) Providence Island, *Perkins;* Stave Island, *Mrs. Flynn.*

NICANDRA. (PHYSALODES)

N. physaloides, Gaertn. Thetford and Peacham, *Blanchard;* Shoreham, *Brainerd.*

PHYSALIS. Ground Cherry

P. **heterophylla,** Nees. (P. Virginiana of the Gray Manual.) Manchester, *Miss Day.*

P. **heterophylla,** Nees. var. **ambigua,** Rydberg. Sandy soil and gardens; occasional.

P. **pruinosa,** L. (P. pubescens, Am. authors in part.) Rutland, *Eggleston;* Pittsford, *G. A. Woolson;* Middlebury, *Brainerd.*

P. **Virginiana,** Mill. Highgate, *Jesup;* St. Johnsbury, *Mrs. M. H. Buckham.*

SOLANUM. Nightshade

S. Dulcamara, L. Moist thickets; frequent.

S. **nigrum,** L. Moist shaded ground; frequent.

SCROPHULARIACEAE. FIGWORT FAMILY

CASTILLEIA

C. pallida, Kunth, var. **septentrionalis,** Gray. (Castilleja acuminata, Spreng.) Mt. Mansfield, *Tuckerman* and *Macrae;* Smuggler's Notch, *Pringle.*

CHELONE

C. glabra, L. Turtle-head. Moist soil; common.

GERARDIA

G. flava, L. (Dasystoma flava, Wood.) Pownal, *Andrews.*

G. pedicularia, L. (Dasystoma pedicularia, Britton.) "Pownal," *Robbins;* "Bellows Falls," *Carey;* Fairlee Cliffs, *Sargent;* Lake Dunmore, *Brainerd.*

G. purpurea, L. var. **paupercula,** Gray. (G. paupercula, Britton.) Knight's and Butler's Islands, *Brainerd;* Highgate, *Wild.*

G. quercifolia, Pursh. (Dasystoma Virginica, Britton.) Dry open woods; Fairlee Cliffs, *Sargent;* Castleton, Pownal, *Robbins, Eggleston;* West Rutland, *Eggleston;* North Dorset, *Mrs. Flynn.*

G. tenuifolia, Vahl. Dry open woods; Pownal, *Robbins, Eggleston;* "Brattleboro," *Robbins;* "Bellows Falls," *Carey;* Vernon, *Grout;* Colchester, *Mrs. Flynn.*

GRATIOLA

G. aurea, Muhl. Sandy shores of Lake Champlain; rare.

G. Virginiana, L. Wet shores and ditches; occasional.

ILYSANTHES

I. attenuata, Small. Wet shores and ditches; occasional.

LINARIA. Toad-flax

L. Canadensis, Dumont. Dry soil; "Bellows Falls," *Carey;* Vernon, *Grout.*

L. VULGARIS, Mill. Butter and Eggs. (Linaria Linaria, Karst.) Fields; common.

MELAMPYRUM

M. Americanum, Michx. (M. lineare, Lam.) Cow-wheat. Dry woodlands; frequent.

MIMULUS

M. MOSCHATUS, Dougl. Musk-plant. Garden escape; wet places. Wallingford, *Kent;* Wardsboro, *Howe;* Weston, *Mrs. Flynn.*

M. ringens, L. Monkey-flower. Wet places; common.

PEDICULARIS

P. **Canadensis**, L. Lousewort. Thickets; common.

PENTSTEMON

P. **laevigatus**, Solander. Fields, Franklin, *Wild*.

P. **pubescens**, Solander. Rocky hills; frequent in western Vermont.

SCROPHULARIA. Figwort

S. **leporella**, Bicknell. Meadows and fence rows; occasional.

S. **nodosa**, L. var. **Marilandica**, Gray. (S. Marilandica, L.) Waste places; occasional.

VERBASCUM

V. Blattaria, L. Moth Mullein. Clay or rocky pastures and roadsides; occasional.

V. Thapsus, L. Mullein. Fields; common.

VERONICA. Speedwell

V. **Americana**, Schweinitz. Wet ground; common.

V. **Anagallis**, L. "Middlebury," *Burge*; Tinmouth Creek, Tinmouth, *Eggleston*.

V. arvensis, L. Fields; occasional.

V. Buxbaumii, Tenore. (V. Byzantina, B. S. P.) Occasionally adventive.

V. **officinalis**, L. Dry fields and thickets; frequent.

V. **peregrina**, L. Gardens and waste places; occasional.

V. **scutellata**, L. Wet ground; common.

V. **serpyllifolia**, L. Roadsides and fields; common.

LENTIBULARIACEAE. BLADDERWORT FAMILY

PINGUICULA

P. **vulgaris**, L. Butterwort. Alpine cliffs, Smuggler's Notch, *Pringle*.

UTRICULARIA. Bladderwort

U. **cornuta**, Michx. Bogs; frequent.

U. **gibba**, L. Rocky pond, Rutland, *Ross*.

U. **inflata**, Walt. In still water; occasional.

U. **intermedia**, Hayne. Shallow pools; occasional.

U. purpurea, Walt. East Barnet, West Danville, Peacham, *Blanchard.*

U. resupinata, B. D. Greene. Fairlee Lake, *Sargent* and *Jesup.*

U. vulgaris, L. Ponds and slow streams; common.

OROBANCHACEAE. BROOMRAPE FAMILY

CONOPHOLIS

C. Americana, Wallroth. Woods on White Creek, *Chandler*; "Rock Point, Burlington," *Macrae;* West Rutland, *H. M. Denslow;* Snake Mountain, *Brainerd.*

EPIPHEGUS. Beech-drops

E. Virginiana. Bart. (Leptamnium Virginianum, Raf.) Under beech trees; common.

OROBANCHE

O. uniflora, L. (Aphyllon uniflorum, Gray; Thalesia uniflora, Britton.) Dry woodlands; occasional.

ACANTHACEAE

DIANTHERA

D. Americana, L. Collected by Dr. Paddock, in 1819, in water at Ferrisburgh; specimen now in University of Vermont herbarium. No later botanist has found it in Vermont.

PLANTAGINACEAE. PLANTAIN FAMILY

LITTORELLA

L. lacustris, L. (L. uniflora, Rusby.) Gravelly shores. Kelley's Bay, Alburgh, *Pringle;* Spectacle Pond, East Wallingford, *Kent;* Notch Pond, Ferdinand, *Eggleston.*

PLANTAGO. Plantain

P. aristata, Michx. (P. Patagonica, Jacq. var. aristata, Gray.) Occasionally introduced with grass seed. Brookline, *Howe;* East Wallingford, *Kent;* Colchester, *Mrs. Flynn.*

P. LANCEOLATA, L. English Plantain. Grass land; common.

P. major, L. Waysides; common.

P. Rugelii, Decaisne. With the preceding species; common.

RUBIACEAE. MADDER FAMILY

CEPHALANTHUS

C. occidentalis, L. Button-bush. Swamps; frequent.

GALIUM. Bed Straw. Cleavers

G. Aparine, L. Shaded ground; frequent.

G. asprellum, Michx. Alluvial ground; common.

G. circaezans, Michx. Rich woods; common.

G. Claytoni, Michx. Wet meadows; frequent.

G. Kamtschaticum, Steller. Cold wet woods of the higher mountains; frequent.

G. lanceolatum, Torr. Dry woods; frequent.

G. Mollugo, L. Peacham, *Blanchard;* "North Pomfret," *Morgan.*

G. palustre, L. Wet meadows and along ditches; common.

G. pilosum, Ait. Dry copses. Pownal, *Robbins, Eggleston.*

G. sylvestre, Pollick. Adventive. Charlotte, *Pringle.*

G. tinctorium, L. (G. trifidum, L. var. latifolium, Torr.) Wet meadows; frequent.

G. tinctorium, L. var. **Labradoricum**, Wiegand. Perch Pond bog, Pownal, *J. R. Churchill.*

G. trifidum, L. (G. trifidum, L. var. pusillum, Gray.) Cold bogs and marshy borders of ponds; frequent.

G. triflorum, Michx. Rich woodlands; common.

G. verum, L. Yellow Bedstraw. Occasionally introduced in grass lands.

HOUSTONIA

H. caerulea, L. Bluets. Grassy places and wet rocks; common.

H. purpurea. L. var. **longifolia**, Gray. (H. longifolia, Gaertn.) Dry rocky places; frequent in the Champlain valley. Randolph, *Bates.*

MITCHELLA

M. repens, L. Partridge-berry. Cool woods; common.

CAPRIFOLIACEAE. HONEYSUCKLE FAMILY

DIERVILLA

D. trifida, Moench. (D. Diervilla, McM.) Rocky woodlands; common.

LINNÆA

L. borealis, L. Twin-flower. Cool, rich woods; frequent.

LONICERA. Honeysuckle

L. caerulea, L. Cold bogs of northeastern Vermont ; occasional.

L. ciliata, Muhl. Fly Honeysuckle. Moist woods ; common.

L. dioica, L. (L. glauca, Hill.) Dry rocky woods ; frequent.

L. hirsuta, Eaton. Rocky woodlands of western Vermont ; occasional.

L. oblongifolia, Muhl. Cold bogs ; "Brattleboro," *Frost ;* Bristol, Monkton, New Haven, Starksboro, *Pringle ;* Sutton, *E. Faxon.*

L. TATARICA, L. Tartarian Honeysuckle. Common in cultivation ; a frequent escape in thickets about Burlington.

SAMBUCUS. Elder

S. Canadensis, L. Elderberry. Thickets ; common.

S. racemosa, L. Red Elder, (S. pubens, Michx.) Rocky woodlands ; common.

SYMPHORICARPOS

S. racemosus, Michx. Snowberry. Common in cultivation ; occasionally spreading from old gardens.

S. racemosus, Michx. var. **pauciflorus,** Robbins. (S. pauciflorus, Britton.) Cliffs and headlands of western Vermont ; occasional.

TRIOSTEUM

T. perfoliatum, L. Rich woodlands ; occasional.

VIBURNUM. Arrow-wood

V. acerifolium, L. Maple-leaf Viburnum. Dry rocky woods ; common.

V. alnifolia, Marsh. (V. lantanoides, Michx.) Hobblebush. Cold moist woods ; common.

V. cassinoides, L. Swamps ; common.

V. dentatum, L. Arrow-wood. Wet places ; frequent.

V. Lentago, L. Sheepberry. Rich moist woods and banks ; frequent.

V. Opulus, L. Cranberry-tree. Low ground ; frequent.

V. pauciflorum, Pylaie. Moist ravines near limit of tree growth ; Mt. Mansfield, *Tuckerman* and *Macrae ;* Killington, *Sargent* and *Eggleston.*

V. pubescens, Pursh. Common on the cliffs and rocky hills of the Champlain valley.

VALERIANACEAE

VALERIANA. Valerian

V. officinalis, L. Garden escape. Franklin, *L. Wild;* Burlington, *Mrs. Flynn.*

V. **sylvatica**, Banks. Cedar swamp, Fairhaven, *Robbins, Seely;* Craftsbury, *Robbins.*

DIPSACEAE. TEASEL FAMILY

DIPSACUS

D. sylvestris, Mill. Wild Teasel. Roadside weed. "Castleton," *Reed;* Shoreham, *Brainerd;* Charlotte, *Pringle.*

SCABIOSA

S. arvensis, L. Scabious. Adventive. Charlotte, *Pringle.*

CUCURBITACEAE. GOURD FAMILY

ECHINOCYSTIS

E. **lobata**, Torr. & Gray. (Micrampelis lobata, Greene.) Wild Cucumber. Alluvial banks and waste places; frequent.

SICYOS

S. **angulatus**, L. Star Cucumber. River banks and waste places; frequent.

CAMPANULACEAE. BELLFLOWER FAMILY

CAMPANULA. Bellflower

C. **aparinoides**, Pursh. Low sedgy thickets; rare.

C. rapunculoides, L. Roadside escape; occasional.

C. **rotundifolia**, L. Harebell. Rocky banks; common.

SPECULARIA. (LEGOUZIA)

S. **perfoliata**, A. DC. Dry rocky woodlands; occasional and local.

LOBELIACEAE. LOBELIA FAMILY

LOBELIA

L. **cardinalis**, L. Cardinal-flower. Swales and margins of ponds and streams; frequent.

L. **Dortmanna**, L. Shallow margins of ponds and bogs; occasional.

L. **inflata**, L. Fields and pastures; common.

L. **Kalmii,** L. Cool moist rocks and fields ; occasional.

L. **spicata,** Lam. Fields and waysides ; occasional.

COMPOSITAE. COMPOSITE FAMILY

ACHILLEA

A. **Millefolium,** L. Yarrow. Dry fields and roadsides ; common.

AMBROSIA. Ragweed

A. **artemisiaefolia,** L. Roman Wormwood. Waste places ; common.

A. **trifida,** L. Moist alluvial soil ; occasional.

ANAPHALIS

A. **margaritacea,** Benth. and Hook. Pearly Everlasting. Dry hills and woods ; common.

ANTENNARIA. Plantain-leaved Everlasting

A. **Brainerdii,** Fernald. (Rhodora I: 153. 1899.) Moist banks, usually in shade ; occasional.

A. **Canadensis,** Greene. Dry and moist ground ; common.

A. **Canadensis,** Greene, var. **Randii,** Fernald. With the type ; occasional.

A. **fallax,** Greene. In partial shade ; occasional.

A. **fallax,** Greene, var. (A. Farwellii, Fernald, Rhodora I: 152. 1899, not Greene.) Meadows and hillsides ; common in Addison county.

A. **neglecta,** Greene. Old fields ; common.

A. **neodioica,** Greene. Old pastures and fields ; frequent.

A. **neodioica,** Greene, var. **attenuata,** Fernald. Dry fields and pastures ; common.

A. **neodioica,** Greene, var. **grandis,** Fernald. Usually in shade ; frequent.

A. **Parlinii,** Fernald. Dry banks and thickets ; occasional.

A. **Parlinii,** Fernald, var. **arnoglossa,** Fernald. (A. arnoglossa, Greene.) Heavy soil ; frequent in Addison county.

A. **petaloidea,** Fernald. Old pastures ; common.

A. **plantaginea,** R. Br. (A. plantaginifolia, Hook.) Dry open woodlands ; occasional.

A. **plantaginea,** R. Br. var. **petiolata,** Fernald. Dry woodlands and hilltops; occasional.

ANTHEMIS

A. Cotula, DC. Mayweed. Waste places; common.

ARCTIUM. Burdock

A. Lappa, L. (A. Lappa, L. var. majus, Gray.) Waste places; frequent, especially in mountain towns.

A. minus, Bernh. (A. Lappa, L. var. minus, Gray.) Waste places; common. A burdock with webbed heads, Manchester, *Miss Day*, represents the form known as var. *tomentosum*, Gray. M. L. Fernald says, however, that it is not the real *A. tomentosum* of Europe and is not to be separated from *A. minus*.

ARTEMISIA. Wormwood

A. Absinthium, L. Dry hills and roadsides; occasional.

A. biennis, Willd. Introduced along railways; occasional.

A. Canadensis, Michx. "Willoughby Lake," *A. Wood;* Smuggler's Notch, *Pringle;* slaty shore of northern Lake Champlain, *Brainerd*.

A. caudata, Michx. Sandy shores of Lake Champlain; occasional.

A. vulgaris, L. Waste places; common.

ASTER

A. acuminatus, Michx. Cool rich woods; common.

A. amethystinus, Nutt. Moist ground. "Brattleboro," *Frost;* South Pownal, *Eggleston*.

A. cordifolius, L. Woodlands; common.

A. cordifolius, L. var. **polycephalus,** Porter. Johnson, *Grout*.

A. diffusus, Ait. (A. lateriflorus, Britton.) Thickets and fields; common.

A. diffusus, Ait. var. **hirsuticaulis,** Gray. (A. hirsuticaulis, Lindl.) Borders of thickets. "Bellows Falls," *Carey;* "Burlington," *Macrae;* Highgate Springs, *Jesup;* Brattleboro, *Grout*.

A. divaricatus, L. (A. corymbosus, Ait.) Moist woodlands; common.

A. dumosus, L. Thickets. Rutland, *Eggleston*.

A. ericoides, L. Dry open places, southern Vermont; occasional.

A. ericoides, L. var. **Pringlei,** Gray. (A. Pringlei, Britton.) Slaty headlands and islands of Lake Champlain; frequent. Manchester, *Miss Day*.

A. junceus, Ait. Peat bogs; rare.

A. laevis, L. Borders of woodlands, southern Vermont; frequent.

A. linariifolius, L. (Ionactis linariifolius, Greene.) Dry sandy soil; occasional.

A. **macrophyllus,** L. Moist woods; common.

A. **macrophyllus,** L. var. **excelsior,** Burgess. Ripton, *Brainerd.*

A. **macrophyllus,** L. var. **pinguifolius,** Burgess. Pownal, *Eggleston;* Lake Dunmore, *Brainerd.*

A. **multiflorus,** Ait. Dry hilly pastures. Pownal, *Robbins, Eggleston;* Vernon, *Grout.*

A. **multiflorus,** Ait. var. **exiguus,** Fernald. In railroad yard, Norwich, *Sargent.*

A. **nemoralis,** Ait. Rocky shores of North Pond, Brunswick, *Eggleston.*

A. **nemoralis,** Ait. var **Blakei,** Porter. Belden Pond, Johnson, *Grout.*

A. **Novae-Angliae,** L. Moist ground; common in western Vermont from Addison county southward, less so elsewhere. Forms with rose-purple rays, var. *roseus,* DC., and with white rays occur; Bennington, *Eggleston.*

A. **Novi-Belgii,** L. Moist shady soil, Connecticut River valley; occasional. A peculiar form occurs in Smuggler's Notch.

A. **paniculatus,** Lam. Shady moist soil; common.

A. **paniculatus,** Lam. var. **bellidiflorus,** Burgess. Rutland, *Eggleston.*

A. **polyphyllus,** Willd. (A. Faxoni, Porter.) Willoughby Mountain, *Tuckerman, Faxon.* "A dwarf form in pastures, Newark and Sutton," *E. Faxon.*

A. **prenanthoides,** Muhl. Newfane, *Grout.*

A. **ptarmicoides,** Torr. and Gray. Dry limestone ledges, Bennington county; occasional.

A. **puniceus,** L. Low thickets and swamps; common.

A. **puniceus,** L. var. **firmus,** Torr. and Gray. (var. lævicaulis, Gray.) Sudbury, *F. W. Hubby.* Specimen in Gray herbarium.

A. **radula,** Ait. "Brattleboro," *Frost;* Cranberry Pond bog, Ferdinand, *Eggleston.*

A. **sagittifolius,** Willd. Dry ground. Common in the Hoosic valley, Pownal, *Eggleston.*

A. **salicifolius,** Ait. Low grounds. North Pownal, rare, *Eggleston.*

A. **tardiflorus,** L. Moist shady ground. Newfane, *Grout;* Rutland, Castleton, *Eggleston;* Manchester, *Miss Day.*

A. **Tradescanti,** L. Low grounds; common.

A. **umbellatus,** Mill. (Doellingeria umbellata, Nees.) Moist thickets; common.

A. **undulatus,** L. Dry copses; common.

A. **vimineus,** Lam. Moist banks; frequent.

A. vimineus, Lam. var. **foliolosus,** Gray. Ledges. Sumner's Falls, Hartland, *Eggleston.*

A. vimineus, Lam. var. **saxatilis,** Fernald. Ledges, Winooski River. Williston, *Pringle.*

BIDENS. Bur Marigold

B. Beckii, Torr. Ponds and deep slow streams ; occasional.

B. cernua, L. Wet places ; common.

B. chrysanthemoides, Michx. (B. laevis, B. S. P.) Wet grounds ; common.

B. connata, Muhl. Low margins of streams and lakes ; frequent.

B. frondosa, L. Beggar's Ticks. Moist waste places ; common.

CENTAUREA

C. Jacea, L. Adventive. Charlotte, *Pringle.*

CHRYSANTHEMUM

C. Leucanthemum, L. White Daisy. Fields and meadows ; common.

CICHORIUM

C. Intybus, L. Chicory. Roadsides and meadows ; common.

CNICUS. (CARDUUS.) Thistle

C. altissimus, Willd. var. **discolor,** Gray. (Carduus discolor, Nutt.) Copses ; occasional.

C. arvensis, Hoffm. Canada Thistle. Fields and waste places ; common.

C. lanceolatus, Hoffm. Bull Thistle. Pastures and roadsides ; common.

C. muticus, Pursh. Swamp Thistle. Swamps and low woods ; frequent.

C. pumilus, Torr. (Carduus odoratus, Porter.) Pasture Thistle. The most common pasture thistle of the southern counties ; unknown north of Rutland county.

CREPIS

C. biennis, L. Adventive. Charlotte, *Pringle.*

ERECHTITES

E. hieracifolia, Raf. Fireweed. Moist woods, especially in recent clearings ; common.

ERIGERON. Fleabane

E. annuus, Pers. Daisy Fleabane. Fields and waste places ; common.

E. bellidifolius, Muhl. (E. pulchellus, Michx.) Copses and moist banks ; common.

E. Canadensis, L. (Leptilon Canadense, Britton.) Horseweed. Waste places; common.

E. hyssopifolius, Michx. Moist rocky river banks and mountain cliffs; occasional.

E. Philadelphicus, L. Moist ground; common.

E. strigosus, Muhl. (E. ramosus, B. S. P.) Fields; common.

EUPATORIUM. Thoroughwort

E. ageratoides, L. Moist rich woods; common.

E. perfoliatum, L. Boneset. Thoroughwort. Low grounds; common.

E. purpureum, L. var. **amoenum**, Gray. Dry open woods. Pownal, *Eggleston*.

E. purpureum, L. var. **maculatum**,[1] Darl. (E. maculatum, L.) Joe-Pye Weed. Moist thickets and low grounds; common.

E. sessilifolium, L. Dry open woods about base of cliff. North Pownal, *Eggleston*.

GALINSOGA

G. PARVIFLORA, Cav. "In waste heaps, Windsor," *Leland;* Burlington, *Grout*. Becoming common as a garden weed. Most of the Burlington plants show spreading pubescence, var. *hispida*, DC.

GNAPHALIUM. Everlasting

G. decurrens, Ives. Hillsides; common.

G. polycephalum, Michx. (G. obtusifolium, L.?) Old fields and woods; common.

G. uliginosum, L. Cudweed. Moist soil; common.

HELIANTHUS. Sunflower

H. annuus, L. Sunflower. An occasional escape.

H. decapetalus, L. Copses and low banks of streams; frequent.

H. divaricatus, L. Thickets and barrens; frequent.

H. giganteus, L. "Brattleboro," *Frost;* "Royalton," *Ward;* Randolph, *Bates*.

H. strumosus, L. Dry woods and banks; occasional.

H. tuberosus, L. Jerusalem Artichoke. Along fences and roadsides; frequent.

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1 Probably the typical *Eupatorium purpureum* occurs in Vermont. Upon looking through the various herbaria, however, no Vermont specimens of it are found and it must therefore be omitted from this list. It should be sought for next season.

HELIOPSIS

H. **scabra**, Dunal. Franklin, *Wild;* Hartford and Norwich, *Sargent.*

HIERACIUM. Hawkweed

H. aurantiacum, L. Orange Hawkweed. Common. A weed pest in pastures and lawns, especially in the northwestern counties.

H. **Canadense**, Michx. Dry cool woods; frequent.

H. **paniculatum**, L. Open woods; frequent.

H. **scabrum**, Michx. Dry open woods; common.

H. **venosum**, L. Dry plains and pine woods; occasional.

INULA

I. Helenium, L. Elecampane. Roadsides and damp pastures; frequent.

KRIGIA

K. **Virginica**, Willd. (Adopogon Carolinianum, Britton.) Dwarf Dandelion. Dry sterile soil; occasional.

LACTUCA. Wild Lettuce

L. **Canadensis**, L. Rich damp soil, borders of fields and thickets; common.

L. **hirsuta**, Muhl. Charlotte, *Pringle.*

L. **integrifolia**, Bigel. Newfane, *Grout;* Pownal, *Eggleston;* Middlebury, *Brainerd.*

L. **leucophaea**, Gray. (L. spicata, Hitchcock.) Low grounds; common.

L. Scariola, L. Prickly Lettuce. Waste places; Rutland, *Jones;* St. Albans, *Orton*; Burlington, *Mrs. Flynn.*

LAPSANA (LAMPSANA)

L. communis, L. Brattleboro, *Frost.*

LEONTODON

L. autumnalis, L. Fall Dandelion. Abundant on village green, Irasburgh, *T. E. Hazen, Wild.*

MATRICARIA

M. discoidea, DC. (M. matricarioides, Porter.) Adventive from Pacific coast. Abundant along railroad and highways, Pownal, *Eggleston.*

ONOPORDON

O. ACANTHIUM, L. Cotton Thistle. "Dry pastures, Williston and Grand Isle," *Robbins;* Charlotte, *Pringle.*

PETASITES

P. palmata, Gray. Sweet Coltsfoot. Wooded borders of cold swamps and streams; occasional. Fairhaven, *Robbins;* Charlotte, *Pringle;* Sutton, *Faxon;* Peacham, *Blanchard.*

PICRIS

P. HIERACIOIDES, L. Adventive from Europe. Charlotte, *Pringle.*

POLYMNIA

P. Canadensis, L. Limestone ledges, Rutland and Proctor, *Eggleston.*

PRENANTHES. (NABALUS.) RATTLESNAKE-ROOT

P. alba, L. Borders of rich woods; occasional.

P. altissima, L. Rich moist woods; common.

P. altissima, L. var. hispidula, Fernald, n. var. "Stem villous or hispid: leaves at least hispidulous on the veins beneath.—VERMONT, Monkton, Sept. 18, 1879, *C. G. Pringle:* MAINE, Augusta, Sept. 2, 1886, *E. C. Smith;* Woodstock, 1887, *J. C. Parlin:* MASSACHUSETTS, North Leominster, Sept., 1891, *Miss L. E. Shedd.*"

P. Boottii, Gray. Mansfield Chin and Nose; *Pringle.*

P. trifoliolata, Fernald, in herb. (Nabalus trifoliolatus, Cass; P. Serpentaria, Gray, in part, not Pursh.) Lion's-foot. Dry sterile soil; frequent.

RUDBECKIA. CONE-FLOWER

R. hirta, L. Yellow Daisy. Meadows; common.

R. laciniata, L. Low thickets; frequent.

SENECIO. GROUNDSEL

S. aureus, L. Golden Ragwort. Swamps; common.

S. Balsamitae, Muhl. (S. aureus, L. var. Balsamitae, Torr. and Gray.) Moist cliffs and rocky banks of streams; frequent.

S. obovatus, Muhl. (S. aureus, L. var. obovatus, Torr. and Gray.) Dry open woods. Bennington and Pownal, common, *Robbins, Churchill.*

S. Robbinsii, Oakes. Common in the cold swamps of northern and central Vermont.

S. VULGARIS, L. Garden weed; occasional.

SERICOCARPUS

S. **conyzoides,** Nees. (S. asteroides, B. S. P.) Dry open woods. Pownal and Arlington, *Robbins;* Vernon, *Grout.*

SOLIDAGO. Goldenrod

S. **arguta,** Ait. Copses and moist woods; common.

S. **bicolor,** L. Dry copses; common.

S. **bicolor,** L. var. **concolor,** Torr. and Gray. (S. hispida, Muhl.) Dry shady cliffs and sterile soil; occasional.

S. **caesia,** L. Rich woodlands; common.

S. **Canadensis,** L. Borders of thickets and fields; common.

S. **Canadensis,** L. var. **glabrata,** Porter. Perch Pond bog, Pownal, *Churchill* and *Eggleston.*

S. **Canadensis,** L. var. **procera,** Torr. and Gray. Manchester, *Miss Day.*

S. **Canadensis,** L. var. **scabra,** Torr. and Gray. Rutland, *Eggleston.*

S. **humilis,** Pursh. (S. Purshii, Porter.) Rocky banks of lakes and streams; occasional. Winooski Gorge, near Burlington, is the station of Pursh's type.

S. **juncea,** Ait. Copses and banks; common.

S. **lanceolata,** L. (Euthamia graminifolia, Nutt.) Moist soil; common.

S. **latifolia,** L. (S. flexicaulis, L.) Moist shaded banks; frequent.

S. **macrophylla,** Pursh. Highest peaks of Green Mountains; common above 3000 feet.

S. **neglecta,** Torr. and Gray. Bogs and swamps; occasional.

S. **nemoralis,** Ait. Dry sterile fields; common.

S. **patula,** Muhl. Swamps; frequent in Bennington county.

S. **puberula,** Nutt. Sandy soil; occasional.

S. **rugosa,** Mill. Borders of fields and copses; common.

S. **serotina,** Ait. Copses and fencerows; common.

S. **serotina,** Ait. var. **gigantea,** Gray. Low grounds and moist thickets; frequent.

S. **squarrosa,** Muhl. Rocky woods; occasional.

S. **uliginosa,** Nutt. Peat bogs; occasional.

S. **ulmifolia,** Muhl. About base of cliffs. North Pownal, *Eggleston.*

S. **Virgaurea,** L. Shady cliffs along the quartzite range of the Green Mountains at altitude of 1000–2000 feet. In the cliffs of Mt. Mansfield and

Willoughby Mountain and on the headlands of Lake Champlain are found the forms described by Porter as var. *monticola* (var. Deanei) var. *Randii* and var. *Redfieldii*.

S. **Virgaurea**, L. var. **alpina**, Bigel. Mansfield Chin; Camel's Hump, *Brainerd*.

SONCHUS. Sow Thistle

S. arvensis, L. Creeping Sow Thistle. Shores and waste places of Champlain valley, becoming frequent; Newfane, *Grout*.

S. asper, Vill. Waste places in rich soil; frequent.

S. oleraceus, L. Waste places with the preceding.

TANACETUM. Tansy

T. vulgare, L. Roadsides; frequent.

T. vulgare, L. var. crispum, DC. With the species; frequent.

TARAXACUM

T. erythrospermum, Andrz. Red-seeded Dandelion. Shallow soil about ledges; frequent. Possibly native.

T. officinale, Weber. (T. Taraxacum, Karst.) Dandelion. Common.

TRAGOPOGON

T. pratensis, L. Goat's-beard. Waste places; frequent.

TUSSILAGO

T. Farfara, L. Coltsfoot. Moist clay banks and along mountain streams; common.

XANTHIUM. Cocklebur

X. **Canadense**, Mill. Shores of lakes and rivers; frequent.

X. **Canadense**, Mill. var. **echinatum**, Gray. Burlington and shores of Connecticut River, *Brainerd*.

X. strumarium, L. Banks of streams and waste places; frequent.

STATISTICAL SUMMARIES

In the following summaries varieties and hybrids are counted with species. When, however, in Tables II and III the numbers are the same, precedence in the list is given to the family or genus containing the fewer varieties and hybrids. The summaries include the species recognized in the list of "Additions and Corrections."

I. NUMBERS AND SYSTEMATIC DISTRIBUTION OF SPECIES

	Native	Foreign	Total
Pteridophytes	81	0	81
Gymnosperms	15	0	15
Angiosperms			
Monocotyledons	441	33	474
Dicotyledons	793	200	993
Totals	1330	233	1563

II. DISTRIBUTION OF SPECIES AND VARIETIES AMONG THE PRINCIPAL FAMILIES OF ANGIOSPERMS

Including all having 15 or more species

Monocotyledons. 15 families. 111 genera

	Genera	*Species and varieties* Native	Foreign	Total
Cyperaceæ	9	192	0	192
Gramineæ	44	101	29	130
Orchidaceæ	14	43	0	43
Liliaceæ	19	26	4	30
Naiadaceæ	4	29	0	29
Juncaceæ	2	19	0	19
The other nine families	19	31	0	31

Dicotyledons. 85 families. 362 genera

	Genera	Native	Foreign	Total
Compositæ	42	140	31	171
Rosaceæ	14	64	12	76
Leguminosæ	17	32	14	46
Labiatæ	25	31	14	45
Cruciferæ	18	25	16	41
Ericaceæ	16	39	0	39
Ranunculaceæ	11	31	4	35
Caryophyllaceæ	11	14	17	31
Polygonaceæ	3	21	10	31
Scrophulariaceæ	13	25	5	30
Salicaceæ	2	22	6	28
Cupuliferæ	8	26	0	26
Umbelliferæ	16	16	5	21
Caprifoliaceæ	7	20	1	21
Rubiaceæ	4	16	3	19
Saxifragaceæ	6	16	0	16
Violaceae	1	16	0	16
The other 68 families	148	239	62	301

III. THE PRINCIPAL GENERA OF ANGIOSPERMS

Including all having ten or more species

Monocotyledons Genera	Species	Dicotyledons Genera	Species
Carex	135	Aster	39
Potamogeton	26	Solidago	25
Scirpus	20	Polygonum	22
Panicum	19	Salix	22
Juncus	15	Viola	16
Eleocharis	15	Rubus	16
Habenaria	12	Galium	15
		Ranunculus	15
		Antennaria	14
		Vaccinium	11
		Quercus	11
		Hypericum	10

IV. THE NATIVE FLORA

It is often difficult to determine whether a plant is native or introduced. In the above summaries those plants are classified as "native," which are considered to be natives of northeastern America and which are, therefore, printed in full-face type in the catalogue, following the usage of the Gray Manual. This is not strictly correct, since a number of such plants have recently been added to the original flora of Vermont from the more immediately adjacent parts of this continent. Some of these like *Rudbeckia hirta* and *Hordeum jubatum* are clearly recognizable as introduced, while others like *Cenchrus tribuloides* and *Chenopodium capitatum* are apparently natives in some localities, although plainly not so in others.

The problem is further complicated by the fact that natural agencies other than man are operative in plant distribution. For example birds not only disseminate seeds locally, but at the migrating season they may carry them long distances. Probably some of our newly recognized forms of *Cratægus* have been brought from the South by migrating crows or other birds within recent years. Disregarding these more natural agencies we have attempted to select from among the species considered to be natives of this continent and, therefore, printed in full-face type in this catalogue, such as have in our judgment been introduced in Vermont by the direct or indirect agency of the white man. This list is doubtless incomplete and imperfect. In our judgment, however. the following plants, except where marked questionable, have been introduced in Vermont. Those followed by a question mark occur usually, if not always, as introduced plants, but it is possible that they may also occur occasionally as

natives. Thirty-seven names are included as unquestionably introduced. If these are deducted from the figures in the above summary it leaves as representing the more strictly native flora of the State 438 monocotyledons and 759 dicotyledons, which added to the Pteridophytes and Gymnosperms gives a revised total of 1293 native species, varieties and hybrids.

Achillea Millefolium, L. ?
Amarantus blitoides, Wats.
Amarantus graecizans, L.
Ambrosia trifida, L.
Arabis perfoliata, Lam. ?
Artemisia biennis, Willd.
Aster multiflorus, Ait. var. exiguus, Fernald.
Atriplex patulum, L.
Baptisia australis, R. Br.
Cassia nictitans, L. ?
Cenchrus tribuloides, L. ?
Chenopodium capitatum, Wats. ?
Chenopodium hybridum, L. ?
Cnicus pumilus, Torr. ?
Crotallaria sagittalis, L. ?
Eragrostis pectinacea, Steud. ?
Eragrostis Purshii, Schrader.
Erysimum cheiranthoides, L. ?
Euphorbia corollata, L.
Festuca ovina, L.
Helianthus annuus, L.
Helianthus tuberosus, L.
Heliopsis scabra, Dunal. ?
Hordeum jubatum, L.
Humulus Lupulus, L. ?
Krigia Virginica, Willd. ?
Lepidium apetalum, Willd.
Lepidium Virginicum, L.
Monarda fistulosa, L. var. rubra, Gray
Monarda punctata, L.
Oxalis stricta, L.
Paspalum setaceum, Michx. ?
Pentstemon lævigatus, Solander.
Phlox paniculata, L.
Physalis heterophylla, Nees.
Physalis heterophylla, Nees, var. ambigua, Rydberg.
Physalis pruinosa, L.
Physalis Virginiana, Mill.
Plantago aristata, Michx.
Plantago major, L.
Polygonum aviculare, L. ?
Polygonum erectum, L.
Polygonum Hydropiper, L.
Polygonum ramosissimum, Michx. ?
Ranunculus repens, L.
Robinia pseudacacia, L.
Robinia viscosa, Vent.
Rudbeckia hirta, L.
Sagina decumbens, Torr and Gray. ?
Sagina procumbens, L. ?
Silene antirrhina, L. ?
Spergularia rubra, Presl.
Spiræa lobata, Jacq.
Stachys palustris, L.
Symphoricarpos racemosus, Michx.
Veronica peregrina, L.
Vicia Cracca, L. ?

SUPPLEMENTARY LISTS

LIST I. The plants of the following list have been reported for Vermont, and in most cases there is a probability that they occur; but we have been unable, after years of search and inquiry, to verify the report. We have, therefore, felt compelled to omit them from the present catalogue. But we would once more call the attention of all collectors in Vermont to the list, hoping that many of these plants may be rediscovered and reported with specimens.

The catalogues referred to are as follows:

James, Edwin. Catalogue of Plants of Middlebury, in Hall's Statistical Account of the Town of Middlebury, 1821.

Oakes, Wm. Catalogue of Vermont Plants, in Thompson's History of Vermont, 1852.

Torrey, Joseph. Catalogue of Vermont Plants. A continuation of the last in Appendix to the History of Vermont, 1853.

Perkins, G. H. Flora of Vermont in the Vermont Agricultural Reports of 1882 and 1888.

Jesup, H. G. Catalogue of the Plants of Hanover, N. H., 1891.

Asclepias purpurascens, L. Brattleboro, Frost; Torrey's Catalogue.
Asclepias verticillata, L. Brattleboro, Frost; Torrey's Catalogue.
Aster dumosus, L. var. strictior, Torr. & Gray. Oakes' Catalogue.
Aster elodes, Torr. & Gray. Brattleboro, Frost; Torrey's Catalogue.
Aster patens, Ait. Barrows; Perkins' Flora.
Calamagrostis Nuttalliana, Steud. Windsor, Leland; Jesup's Flora.
Carex gynocrates, Worm. Burlington, Torrey; Perkins' Flora.
Carex trichocarpa, Muhl. Burlington, Torrey; Perkins' Flora.
Carex varia, Muhl. Bellows Falls, Carey; Oakes' Catalogue.
Carex vestita, Willd. Middlebury, James; Oakes' Catalogue.
Cimicifuga racemosa, Nutt. Middlebury, James; Mt. Mansfield, Shelburne, Rock Point, Burlington, Macrae; Oakes' Catalogue.
Crataegus tomentosa, L. Southern Vermont; Perkins' Flora.
Crataegus tomentosa, L. var. B., Torr. & Gray. Bellows Falls, Carey; Oakes' Catalogue.
Desmodium canescens, DC. Pownal, Robbins; Oakes' Catalogue.
Eragrostis capillaris, Nees. Bellows Falls, Carey; Oakes' Catalogue.
Festuca tenella, Willd. Bellows Falls, Carey; Oakes' Catalogue.
Festuca ovina, L. var duriuscula, Koch; Oakes' Catalogue.
Galeopsis Ladanum, L. Bellows Falls, Carey; Oakes' Catalogue.

Geranium Carolinianum, L. Bellows Falls, Carey ; Oakes' Catalogue.

Glyceria obtusa, Trin. Bellows Falls, Carey ; Oakes' Catalogue.

Hieracium Gronovii, Tourn. Colchester, Torrey ; Brattleboro, Frost ; Torrey's Catalogue.

Hypoxis erecta, L. Brattleboro, Frost ; Torrey's Catalogue.

Isoetes Engelmanii, Braun. var. gracilis, Engelm. Frost ; Perkins' Flora.

Linum Virginianum, L. Pownal, Robbins ; Oakes' Catalogue.

Muhlenbergia sobolifera, Trin. Oakes' Catalogue.

Oxalis violacea, L. Cavendish, Dr. Graves ; N. Pomfret, A. P. Morgan ; Jesup's Flora.

Plantago Virginica, L, Brattleboro, Frost ; Torrey's Catalogue.

Poa trivialis, L. Perkins' Flora.

Podostemon ceratophyllus, Michx. Brattleboro, Frost; Torrey's Catalogue.

Polygonella articulata, Meisn. Colchester Point, Pringle ; Perkins' Flora.

Potamogeton pulcher, Tuckerm. Brattleboro, Frost ; Torrey's Catalogue.

Pyrus arbutifolia, L. f. var. erythrocarpa. Oakes' Catalogue.

Quercus coccinea, Wang. Oakes' Catalogue.

Ranunculus sceleratus, L. Oakes' Catalogue.

Salix alba, L. Perkins' Flora.

Scleria triglomerata, Michx. Vermont ; Gray Manual and Britton & Brown Illustrated Flora.

Scirpus polyphyllus, Vahl. Pownal, Robbins ; Oakes' Catalogue.

Sisymbrium canescens, Nutt. Lake Champlain, Michaux ; Oakes' Catalogue.

Sisymbrium Thaliana, Gaud. A. Wood ; Torrey's Catalogue.

Smilax rotundifolia, L. Oakes' Catalogue.

Solidago odora, Ait. Oakes' Catalogue.

Trifolium procumbens, L. Perkins' Flora.

Urtica dioica, L. Oakes' Catalogue.

Viola pedata, L. Brattleboro, Frost ; Torrey's Catalogue.

List II. The following species have appeared in former lists of Vermont plants ; but are now omitted as they have proved to be mere waifs, or, if occasionally spontaneous, not persisting.

Æsculus Hippocastanum, L.
Bromus hordaceus, L.
Isatis tinctoria, L.
Ligustrum vulgare, L.
Koeleria cristata, Pers.
Lycopus arvensis, L.
Melissa officinalis, L.
Myosotis arvensis, Hoffm.
Oenothera laciniata, Hill.[1]
Papaver dubium, L.
Ribes aureum, Pursh.
Veronica Virginica, L.

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1 "Naturalized in Vermont" Britton Brown, Ill., Flora, II 487. This doubtless refers to plants collected at Fort Ethan Allen by Grout and Jones, in 1896, which were waifs.

LIST III. The following is a list of plants omitted from the present catalogue, although given in Perkins' Flora of Vermont, 1888 edition. Some of them are known to have been errors in determination, others represent specific names which have been suppressed in recent revisions, and the balance are so far out of their range that there is little doubt that they have been incorrectly assigned to the flora of the State.

Amarantus chlorostachys, Willd.
Anychia dichotoma, Michx.
Asclepias variegata, L.
Carex Crawei, Dewey.
Carex laxiflora, Lam. var. intermedia, Boott.
Carex rosea, Schkuhr. var. retroflexa, Torr.
Carex rostrata, With.
Carex striata, Michx.
Carex Shortiana, Dewey.
Carex tetanica, Schkuhr, var. Meadii, Bailey.
Cnicus horridulus, Pursh.
Clematis Viorna, L.
Cyperus setigerus, T. & H.
Desmodium rotundifolium, DC.
Draba verna, L.
Eleocharis rostellata, Torr.
Eriocaulon decangulare, Michx.
Gerardia purpurea, L.
Habenaria ciliaris R. Br.
Helianthus tracheliifolius, Willd.
Hypericum mutilum L. var. gymnanthemum, Gray.
Juncus acuminatus, Michx. var. debilis, Engelm.
Leucothœ racemosa, Gray.
Lepidium ruderale, L.
Lycopus Europæus, L.
Myriophyllum heterophyllum, Michx.
Œnothera fruticosa, L.
Panicum amarum, Ell.
Pycnanthemum aristatum, Michx.
Pyrola rotundifolia, L. var. incarnata, DC.
Rumex aquatica, L.
Rumex sanguineus, L.
Sagittaria lancifolia, L.
Sagittaria natans, Michx.
Seriococarpus solidagineus, Nees.
Sisyrinchium albidum, Raf.

Solidago rigida, L.
Trifolium stoloniferum, Muhl.
Thaspium aureum, Nutt.
Thaspium trifoliatum, Gray.
Thaspium trifoliatum, Gray, var. apterum, Gray.
Tipularia discolor, Nutt.
Triodia cuprea, Jacq.
Viola striata, Ait.
Viola tricolor, L. var. arvensis, L.
Vitis cordifolia, Michx.
Vitis riparia, Engelm.

List IV. The following species have been found near the Vermont line and it is probable that they occur within the State :

Asclepias incarnata L. var. pulchra, Pers. Negro Island, Connecticut River, Hanover, N. H.
Aster Lindleyanus, Torr. & Gray. Wantastiquet Mountain, Hinsdale, N.H.
Aster Schreberi, Nees. "Abundant in the Connecticut River valley on the N. H. side." M. L. Fernald.
Calamintha Acinos, Benth. Within a few rods of the State line at Williamstown, Mass.
Myriophyllum verticillatum, L. Lebanon, N. H.
Rosa nitida, Willd. Enfield and New London, N. H.
Sisymbrium canescens, Nutt. Shore of Lake Champlain, N. Y.
Spiranthes simplex, Gray. Near Williamstown, Mass.
Stellaria longipes, Goldie. Claremont, N. H.; Williamstown, Mass.
Vaccinium stamineum, L. Greylock Mountain, Williamstown, Mass.
Verbena angustifolia, Michx. Hanover, N. H.
Xyris flexuosa, Muhl. var. pusilla, Gray, Plainfield, N. H.

LESSER FLORAS

The natural congregations among wild plants furnish most interesting problems to the botanist, and this interest deepens and the profit from the study grows when one seeks beyound the mere fact of the occurrence of certain plants in certain localities for the explanation of such occurrence. It was hoped when this catalogue was planned that some more adequate discussion of our flora might be given along these lines. Lack of space and time alike forbid that this plan be carried out in full. All that can now be attempted is the inclusion of the bare lists of a few of the more important of these lesser floras.

ALPINE

The following plants occur only, or principally, on the alpine summits of the Green Mountains, or in the higher mountain cliffs, as at Smuggler's Notch.

Agrostis canina, L. var. alpina, Oakes.
Arenaria Groenlandica, Spreng.
Arenaria verna, L. var. hirta, Wats.
Asplenium viride, Hudson.
Betula papyrifera, Marsh, var. minor, Tuckerm.
Carex atrata, L. var. ovata, Boott.
Carex canescens, L. var. alpicola, Wahl.
Carex rigida, Gooden, var. Bigelovii, Tuckerm.
Carex scirpoidea, Michx.
Castilleia pallida, Kunth. var. septentrionalis, Gray.
Comandra livida, Richard.
Deschampsia atropurpurea, Scheele.
Diapensia Lapponica, L.
Empetrum nigrum, L.
Festuca brachyphylla, Schultes.
Gentiana Amarella, L. var. acuta, Hook. f.
Hierochloe alpina, R. & S.
Juncus trifidus, L.
Luzula spicata, Desvaux.
Lycopodium annotinum, L. var. pungens, Spring.
Lycopodium Selago, L.
Poa laxa, Haenke.
Polygonum viviparum, L.
Prenanthes Boottii, Gray.
Salix phylicifolia, L.
Salix Uva-ursi, Pursh.
Scirpus cæspitosus, L.
Solidago Virgaurea, L. var. alpina, Bigel.
Vaccinium Pennsylvanicum, Lam. var. angustifolium, Gray.
Vaccinium uliginosum, L.
Vaccinium Vitis-Idæa, L.

SUB-ALPINE OR MONTANE

The following plants occur characteristically at high altitudes, and are rarely found below 1500 feet.

Agropyron Novæ-Angliæ, Scribn.
Alnus viridis, DC.
Amelanchier oligocarpa, Roem.
Aspidium aculeatum, Swartz. var. Braunii, Koch.
Aspidium fragrans, Swartz.
Aspidium spinulosum, Swartz, var. dilitatum, Hook.
Astragalus Blakei, Eggleston.
Braya humilis, Robinson.
Calamagrostis breviseta, Scribn. var. lacustris, Kearney.
Calamagrostis hyperborea, Lange.
Calamagrostis hyperborea, Lange, var. Americana, Kearney.
Calamagrostis inexpansa, Gray.
Calamagrostis Langsdorfii, Trin.
Draba incana, L.
Epilobium lineare, Muhl. var. oliganthum, Trelease
Galium Kamtschaticum, Steller.
Gentiana linearis, Froel.
Geum macrophyllum, Willd.
Goodyera repens, R. Br.
Goodyera tesselata, Ladd.
Habenaria frimbriata, R. Br.
Habenaria obtusata, Richards.
Hedysarum boreale, Nutt.
Luzula spadicea, DC. var. melanocarpa, Meyer.
Lycopodium sabinæfolium, Willd.
Myriophyllum Farwellii, Morong
Pinguicula vulgaris, L.
Potentilla tridentata, Ait.
Primula Mistassinica, Michx.
Pyrola minor, L.
Pyrus sambucifolia, C. & S.
Ribes lacustre, Poir.
Ribes prostratum, L'Her.
Salix balsamifera, Barratt.
Saxifraga aizoides, L.
Saxifraga Aizoon, Jacq.
Saxifraga oppositifolia, L.
Solidago macrophylla, Pursh.
Solidago Virgaurea, L.
Vaccinium cæspitosum, Michx.
Viburnum pauciflorum, Pylaie.
Woodsia glabella, R. Br.
Woodsia hyperborea, R. Br.

SAND-PLAIN

The following are characteristically sand-plain plants.

Andropogon nutans, L. var. avenaceus, Hack.
Asclepias obtusifolia, Michx.
Aster linariifolius, L.
Carex Houghtonii, Torr.
Carex Muhlenbergii, Schkuhr.
Carex siccata, Dewey.
Convolvulus spithamæus, L.
Fimbristylis capillaris, Gray
Helianthemum majus, B. S. P.
Hieracium venosum, L.
Lespedeza capitata, Michx.
Lupinus perennis, L.
Prunus cuneata, Raf.
Pinus rigida, Mill.
Polygala polygama, Walt.
Quercus ilicifolia, Wang.
Polygala sanguinea, L.
Salix humilis, Marsh.
Solidago puberula, Nutt.
Spiranthes gracilis, Bigel.
Viola arenaria, DC.

HEADLANDS OF LAKE CHAMPLAIN

Plants found on the rocky and exposed promontories of slate, limestone or red sand-rock. The cliffs and red sand-rock hills of the southern Champlain Valley more remote from the lake, like Buck Mountain and Snake Mountain, have a flora similar to these headlands.

Arabis confinis, Wats.
Arenaria stricta, Michx.
Aster ericoides, L. var. Pringlei, Gray.
Corydalis aurea, Willd.
Draba incana, L. var. arabisans, Wats.
Houstonia purpurea, L.
Lathyrus ochroleucus, Hook.
Pentstemon pubescens, Soland.
Pimpinella integerrima, Gray.
Poa nemoralis, L.
Polygonum Douglasii, Greene.
Rhus Canadensis, Marsh.
Rosa acicularis, Lindl.
Scutellaria parvula, Michx.
Shepherdia Canadensis, Nutt.
Solidago bicolor, L. var. concolor, T. & G.
Solidago humilis, L.
Symphoricarpos racemosus, Michx. var. pauciflorus, Robbins.
Trisetum subspicatum, Beauv.
Viburnum pubescens, Pursh.
Zygadenus elegans, Pursh.

COLD SPHAGNUM BOGS

Amelanchier Canadensis, T. & G. var. oblongifolia, T. & G.
Andromeda polifolia, L.
Arethusa bulbosa, L.
Aster junceus, Ait.
Calopogon pulchellus, R. Br.
Calypso borealis, Salisb.
Carex chordorhiza, Ehrh.
Carex exilis, Dewey.
Carex folliculata, L.
Carex fusca, All.
Carex livida, Willd.
Carex Magellanica, Lam.
Carex oligosperma, Michx.
Carex pauciflora, Lightf.
Carex saltuensis, Bailey.
Carex tenella, Schkuhr.
Carex tenuiflora, Wahl.
Carex teretiuscula, Gooden.
Carex trisperma, Dewey.
Chiogenes serpyllifolia, Salisb.
Drosera intermedia, Hayne.
Eleocharis pauciflora, Link.
Epilobium strictum, Muhl.
Eriophorum alpinum, L.
Eriophorum gracile, Koch.
Eriophorum gracile, Koch, var. paucinervium, Engelm.
Eriophorum vaginatum, L.
Geum rivale, L.
Habenaria dilatata, Gray.
Kalmia glauca, Ait.
Larix Americana, Michx.
Ledum Grœlandicum, Oeder.
Listera cordata, R. Br.
Lonicera cærulea, L.
Lonicera oblongifolia, Muhl.
Microstylis monophyllus, Lindl.
Orchis rotundifolia, Pursh.
Picea nigra, Link.
Poa pratensis, L. var. angustifolia, Smith.

Potentilla palustris, Scop.
Pyrola secunda, L. var. pumila, Gray.
Pyrola rotundifolia, L. var. uliginosa, Gray.
Salix candida, Willd.
Rhamnus alnifolius, L'Her.
Salix myrtilloides, L.
Sarracenia purpurea, L.
Scirpus atrocinctus, Fernald.
Senecio Robbinsii, Oakes.
Smilacina trifolia, Desf.
Solidago neglecta, T. & G.
Solidago uliginosa, Nutt.
Vaccinium macrocarpon, Ait.
Vaccinium Oxycoccus, L.
Valeriana sylvatica, Banks.
Viburnum cassinoides, L.

ADDITIONS AND CORRECTIONS.

Page 5. **Juniperus communis,** L. var. According to Rehder, Cycl. of Am. Hort. 848, the common spreading juniper of New England pastures is var. *Canadensis*, Loud., while the var. *nana*, Loud. (J. nana, Willd.) is a plant of arctic and mountain regions, low and prostrate with shorter and broader leaves, $\frac{1}{4}$–$\frac{1}{2}$ in. long.

Page 8. For **Alisma Plantago-aquatica,** L. read—**Alisma Plantago,** L. (Linnæus in Sp. Pl. 342, uses the latter name.)

Page 9. After **Agropyron Novae-Angliae,** add the following description, by Professor F. Lamson-Scribner:

Agropyron Novae-Angliae, Scribn. sp nov. (*Triticum violaceum*, A. Gray, Man. ed. 5. 638. 1867, at least in part, not Hornem. Fl. Dan. *t. 2044; Agropyron violaceum*, var., S. Wats. in A. Gray, Man. ed. 6. 672. 1890, not *A. violaceum*, Lange, Consp. Fl. Groenland. 154. 1880; *A. violaceum virescens*, Lange, l. c. ?)—An erect cæspitose perennial 6–10 dm. high, with rather long broad leaves and erect spikes 12–16 cm. long; culms smooth; sheaths striate, shorter than the internodes; ligule short; leafblades linear 20–25 cm. long, 4–10 mm. wide, long acuminate, narrowed at the base, striate, scabrous on the margins and nerves, sometimes glabrous, rarely with very few scattered hairs above, leaves of the innovations much smaller, narrow. Axis flattened, glabrous except on the ciliate-scabrous angles. Spikelets appressed, 14–16 mm. long, 3 to 5 flowered; rachilla rather densely hispid; empty glumes lanceolate, sub-equal, prominently 5 nerved, 12 mm. long, scabrous on the nerves and at the apex, bearing a short scabrous awn usually 2 mm. long; flowering glumes lanceolate, glabrous, 8–9 mm. long, rather faintly 3 to 5 nerved, short awn-pointed. Palea nearly equaling the glume, 2 nerved, scabrous on the margin, truncate or 2-toothed at the scabrous apex.

General distribution: Sandy shores, thickets, etc., Labrador and Newfoundland south to New York and Pennsylvania, west to Wisconsin and South Dakota, June to September.

Specimens examined: LABRADOR: Hamilton River, 6071, *A. P. How*, Aug. 17, 1894, ex. Herb. Geol. Surv. Canada. NEWFOUNDLAND: Middle Arm, 26, *A. C. Waghorne*, 1897; no locality, *Waghorne*, 1897. QUEBEC: sandy shore near Cacouna, *C. G. Pringle*, July 25, 1881. ONTARIO: Lake Nipigon, *J. Macoun*, July 17, 1884. MAINE: dry bank, Dead River, 576, *M. L. Fernald*, August 19, 1896. NEW HAMPSHIRE: White Mountains, *C. E. Faxon*, August 28, 1882; Oakes Gulf, Mt.

Washington, 1736, *W. W. Eggleston,* July 28, 1899 ; Corydon Mountain, *B. P. Ruggles*, July 20, 1892, 14, ex. Herb. Univ. Vermont. VERMONT : gravelly talus of cliffs, Willoughby Mountain, Westmore, *A. J. Grout* and *W. W. Eggleston,* July 2, 1894 (type). NEW YORK : in dry sandy soil, Ray Brook, Essex County, 8, *C. H. Peck*, August, 1897 ; Brownville, *C. H. Peck*, 1882. PENNSYLVANIA : Huntingdon County, *T. C. Porter*, July 1868, Sept. 10, 1860. WISCONSIN : Dalles, *F. F. Wood*, 1891. SOUTH DAKOTA : Sylvan Lake, 714, *David Griffiths*, August 27, 1897.

This species has been variously referred to *Agropyron tenerum* Vasey, *A. violaceum*, Lange, and *A. repens*, Beauv. From the latter it is distinguished at once by its cæspitose habit, absence of a rootstock, leaves not auriculate at the base, strongly nerved outer glumes and peculiar hispid rachilla of the spikelets. From *A. violaceum* it is distinguished by its much longer and broader leaves, usually green, rarely purplish and longer spikes, and from *A. tenerum* by its much broader, less rigid leaves and hispid rachilla.

The plant described in Gray's Manual, ed. 6, 672. is the western form which is doubtless true *Agropyron violaceum*, Lange, while the variety mentioned "with longer usually pale narrow spikes and attenuate often long-awned glumes," is the plant here described as *Agropyron Novæ-Angliæ.*

Page 13. For **Glyceria fluitans,** R. Br., read—**Glyceria borealis,** Batchelder. This name, published in Proc. Manchester, (N. H.), Inst. 1 : 74, 106, is synonymous with var. *angustata*, Vasey, and *Panicularia borealis*, Nash.

Page 14. For P. GLABRUM, Gaudin, etc., read—P. LINEARE, Krock. (P. glabrum, Gaudin. Syntherisma linearis, Nash.)

Under **P. xanthophysum,** form **amplifolium,** insert the following description by Professor F. Lamson-Scribner :

Panicum xanthophysum forma **amplifolium,** Scribn. Culms stout ; lower sheaths crowded, strongly striate and papillate-hirsute ; blades firm, 10–20 mm. wide. Dry sandy soil, Burlington, Vt. L. R. Jones, collector, August 31, 1893.

Page 15. Eleventh line from top, for **P. psammophilum,** Scribn, read—**P. psammophilum,** Nash.

Professor Scribner has re-examined the Vermont specimens of the *Panicum dichotomum* group and the following additions and corrections to the statements made on page 15, are based upon notes contributed by him :

P. Atlanticum. Erase this name as the plant doubtfully so referred is a form of *P. unciphyllum*, Trin. See below.

P. dichotomum, Linn. These plants represent the var. *viride*, Vasey, a form considered as *P. dichotomum*, L. by common consent since they correspond more nearly than any other form to the original description of the species.

For **P. pubescens** read **P. unciphyllum,** Trin. This is one of the commonest species of this group. Professor Scribner sends the following statements as to the synonymy :

" *Panicum pubescens* of recent authors, not Lamarck. Recent examination of the type of this species in Lamarck's Herbarium, Museum de Historie Naturelle de Paris, proves it to be the late branched form of *Panicum scoparium*, Lam., which is entirely different from the form so considered by American authors and is *Panicum viscidum*, Ell. Synonomy : *Panicum scoparium*, Lam. Encycl 4: 744, 1797. (*Panicum pubescens*, Lam. 1. c. 748; *Panicum viscidum*, Ell. Sk. Bot. S. C. and Ga. 1: 123, 1817.) See Bull. 24, U. S. Dept. Agr. Div. Agros.

For the form previously referred to *Panicum pubescens* we have taken up the name *Panicum unciphyllum*, Trin. Gram. Pan. 242, 1826. Our reason for taking up this name is this—in the Herbarium of Columbia University is a specimen referable to the form here taken up as *P. unciphyllum*, labelled in Torrey's handwriting "Panicum unciphyllum, Trin. in lit." which was evidently named by Trinius and moreover the specimen agrees with Trinius',description. It is of course possible that this plant may not be the same as the type of *Panicum unciphyllum*, Trin., but we feel justified in taking up this old name for the species in question, rather than applying a new name to this very common grass."

P. sphaerocarpon, Ell. Erase this name. The plants collected on Sterling Mountain are a peculiar form of *P. boreale*, Nash.

P. tsugetorum, Nash. Erase this name. The plant so referred is *P. lanuginosum*, Ell. (P. Tennesseense, Ashe.) The record, "Burlington, *Jones*," should therefore be transferred to *P. lanuginosum*.

Page 18. Under **Carex folliculata,** L , insert—Sunderland, *Eggleston*.

Under **Carex formosa,** Dewey, erase—" Sunderland, *Eggleston*."

Page 26. Insert—**Juncus Dudleyi,** Wiegand. (Bull. Torr. Bot. Club, 27: 524, 1900.) Pownal, *Eggleston* and *Churchill*; Willoughby, *G. G. Kennedy*, specimen in herbarium New Eng. Bot. Club.

Page 27. After **Luzula vernalis,** DC., insert as synonym—(J. pilosum, Kuntze).

For LILUM read LILIUM.

After MAIANTHEMUM insert as synonym—(UNIFOLIUM).

Page 30. Fourth line from top for "attitudes" read "altitudes."

After LIPARIS insert as synonym—(LEPTORCHIS).

Page 36. After **Polygonum Careyi,** Olney, add—abundant at foot of Proctorsville Gulf, Cavendish, *M. L. Fernald.*

Fourth line from bottom, for **P. Convolvulus,** read P. CONVOLVULUS.

Page 39. After **Arenaria macrophylla,** Hook, insert as a synonym—(Moehringia macrophylla, Torr.).

Page 40. Fifth line from bottom, for **B. peltata,** etc., read **B. Schreberi,** Gmelin. (B. peltata, Pursh. B. purpurea, Casp.)

Page 46. Transfer "woods;" from end of second line to end of first line.

Page 53. After **S. salicifolia,** L. var. **latifolia,** for "Wiegand" read "Ait."

Page 54. Twelfth line from top, for B. AUSTRALIS read **B. australis,** and for "Ward" read "Wild."

Page 57. Fourth line from bottom, after **E. corallata,** insert—L.

Page 60. Fourth line from bottom, for **A. Ascyron,** read **H. Ascyron.**

Page 62. Tenth line from bottom, for **AEAGNACEAE,** read **ELAEAGNACEAE.**

Seventh line from bottom, for **LTHYRACEAE,** read **LYTHRACEAE.**

Page 68. Under **Rhododendron maximum,** for "Eggleston" read "Burbank."

Page 72. Add—**Hydrophyllum Canadense,** "Mt. Mansfield and south western Vermont," *Robbins;* Charlotte, *Pringle.* The latter's specimens were somewhat abnormal but were so named by Dr. Gray.

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